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Burke et al.

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(54) **UNIVERSAL BRAKE BEAM STRUT**

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(51) **Int. Cl.**
B61H 13/36 (2006.01)

(52) **U.S. Cl.**
CPC ***B61H 13/36*** (2013.01)

(58) **Field of Classification Search**
CPC B61H 13/36; B61H 13/00
USPC 188/229.1, 229.6, 231–232, 219.1, 188/223.1, 226.1
See application file for complete search history.

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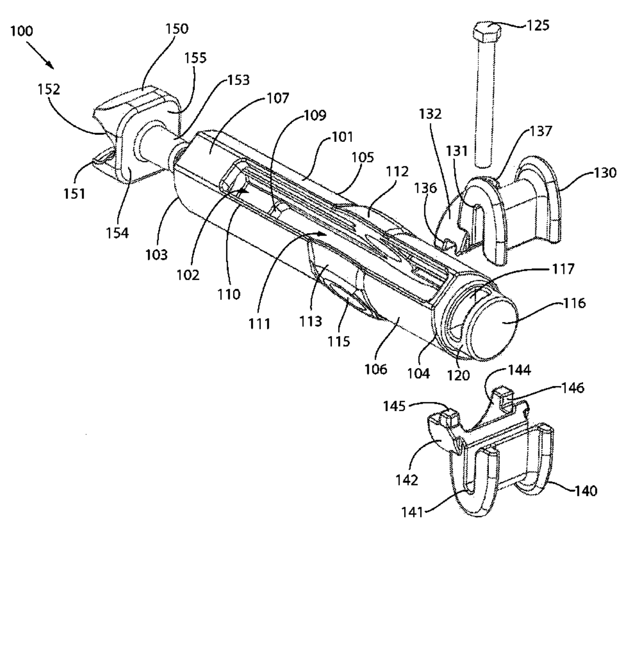
(57) **ABSTRACT**

A strut for a brake beam assembly includes a strut body extending along a longitudinal axis between a proximal end and a distal end. At least one slot is defined in the strut body and receives and supports a brake lever extending non-parallel to the longitudinal axis. A compression member engager is connected to a distal end of the strut body and is configured to connect the strut body to a compression member of the brake beam assembly. A tension member engager is connected to the proximal end of the strut body and is configured to engage a tension member of the brake beam assembly. At least one fastener is configured to engage the compression member engager to fasten the compression member engager on the compression member. At least a portion of the strut body is rotatable about the longitudinal axis with respect to the compression member engager and the tension member engager to be oriented at opposing angles with respect to a horizontal plane extending through the longitudinal axis.

17 Claims, 29 Drawing Sheets



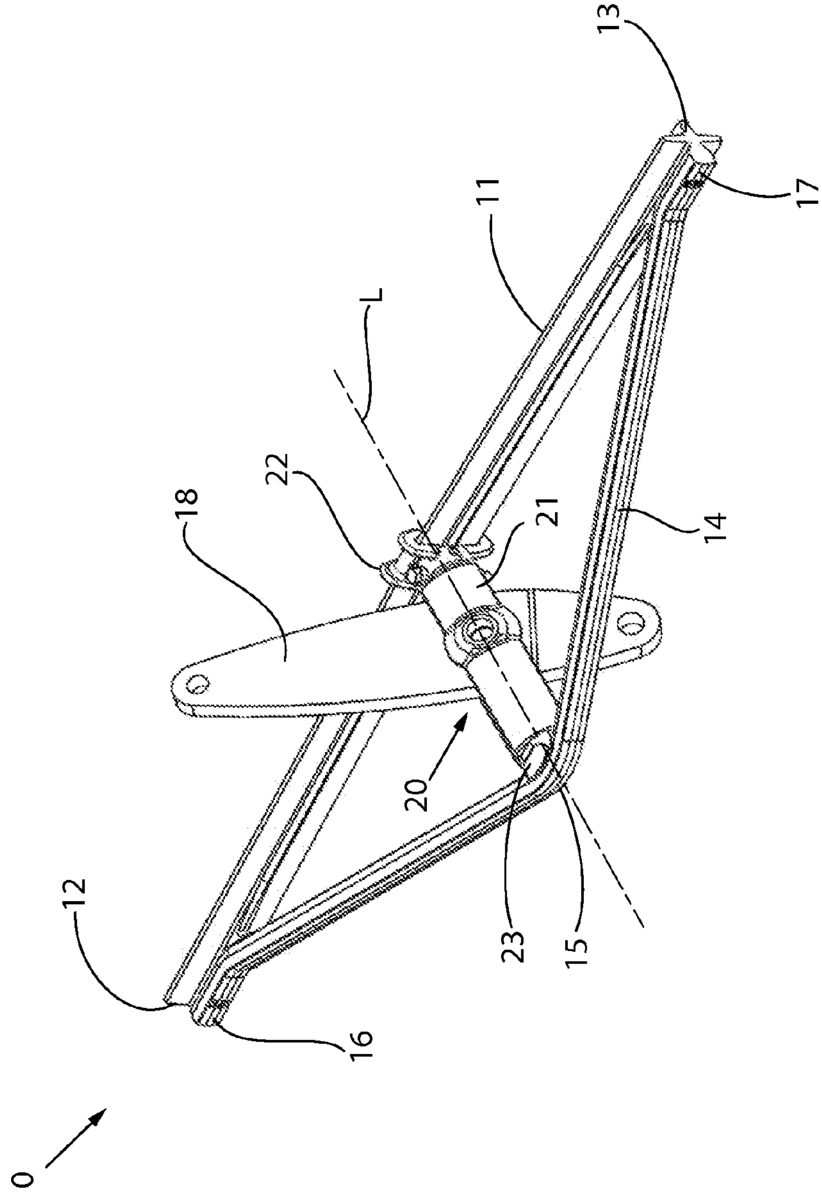


FIG. 1

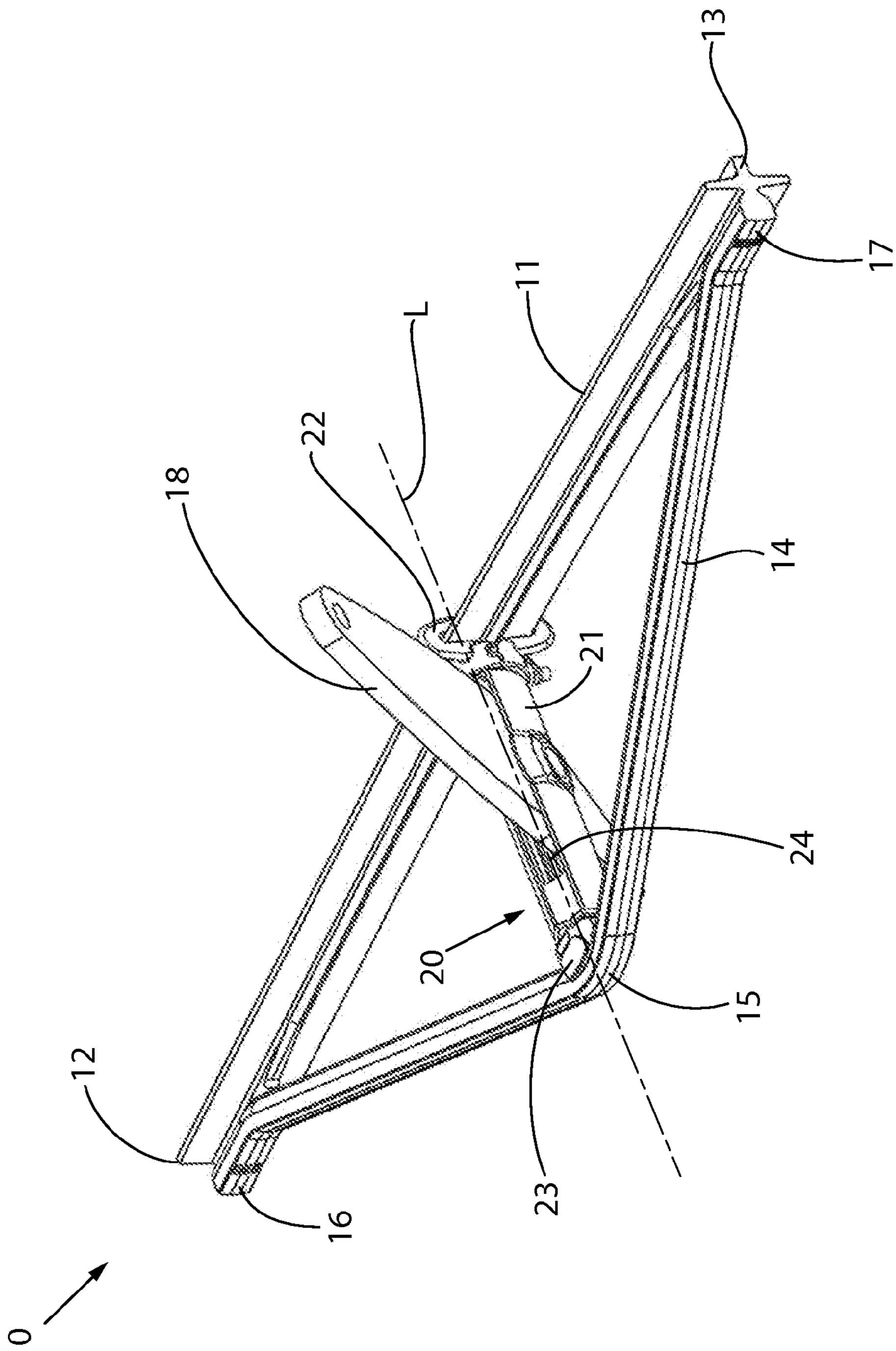


FIG. 2

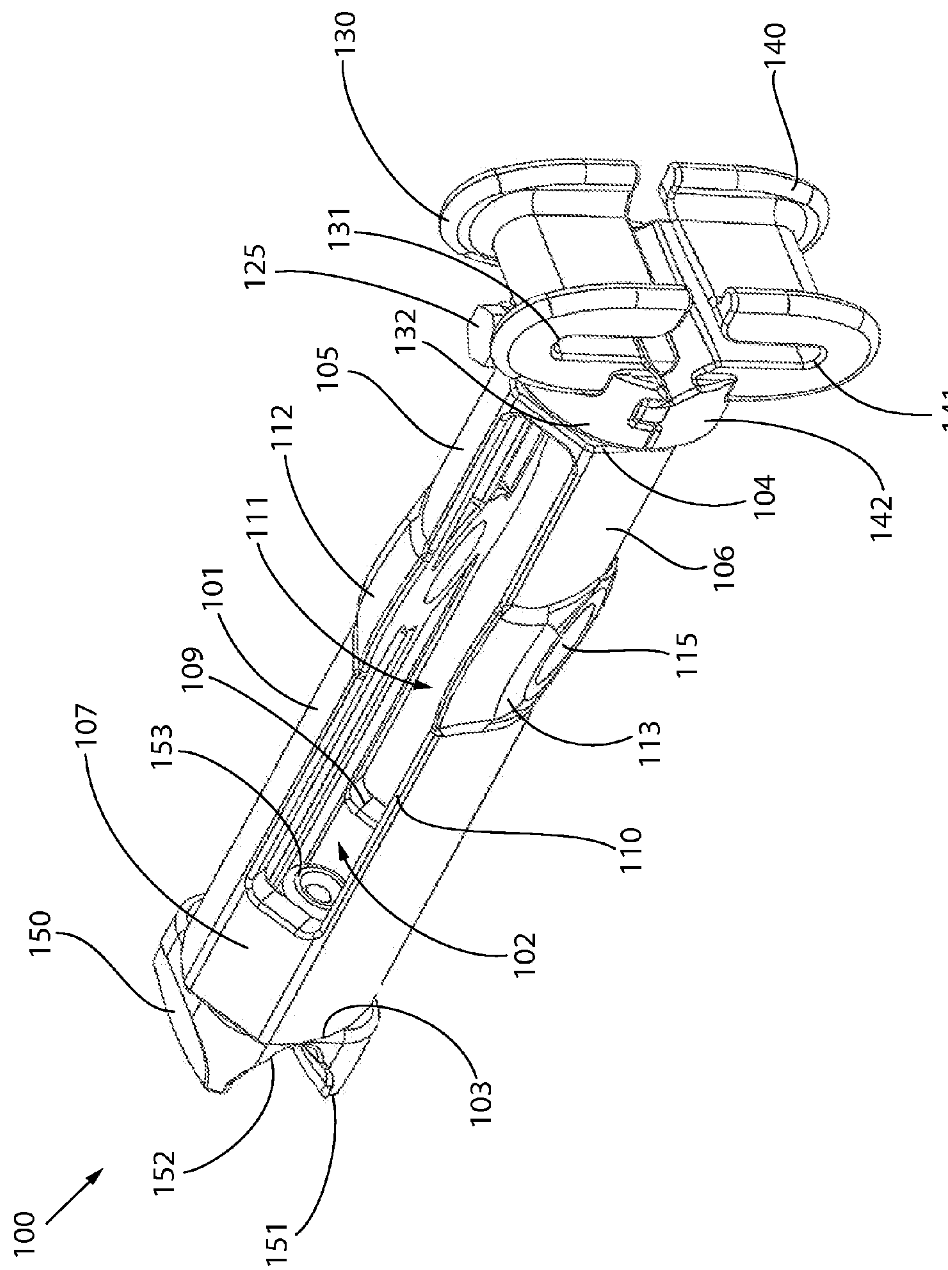

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FIG. 3

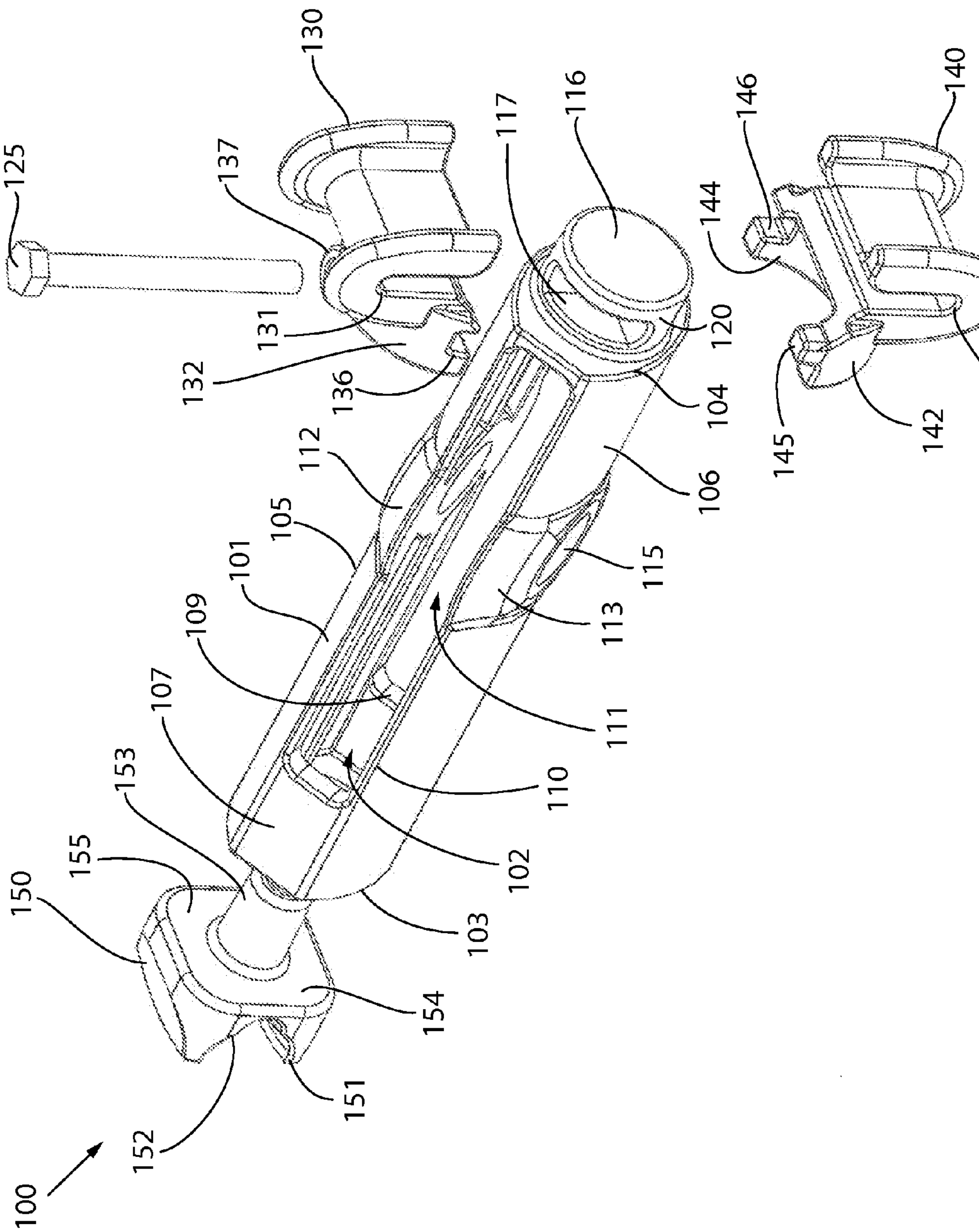
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FIG. 4

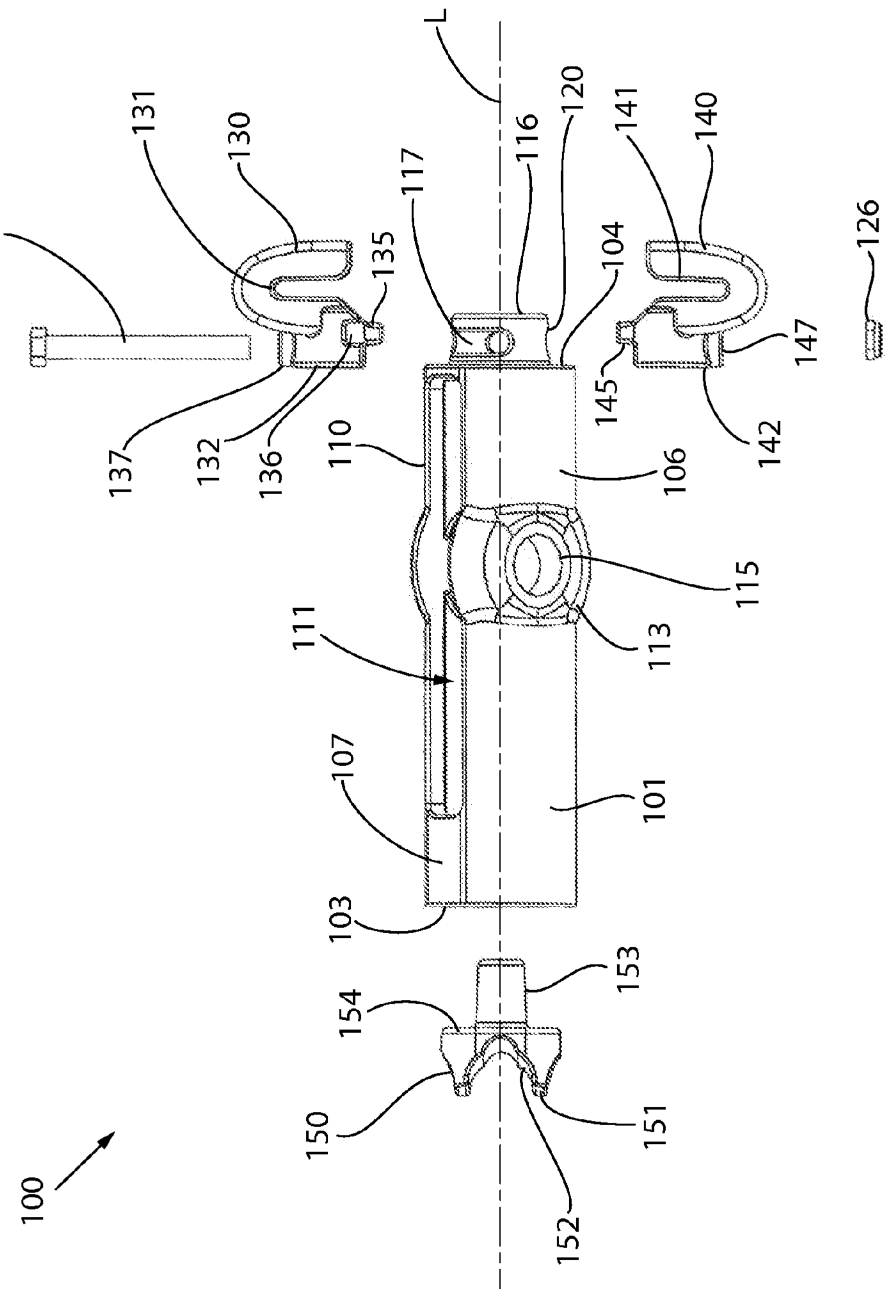
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FIG. 5

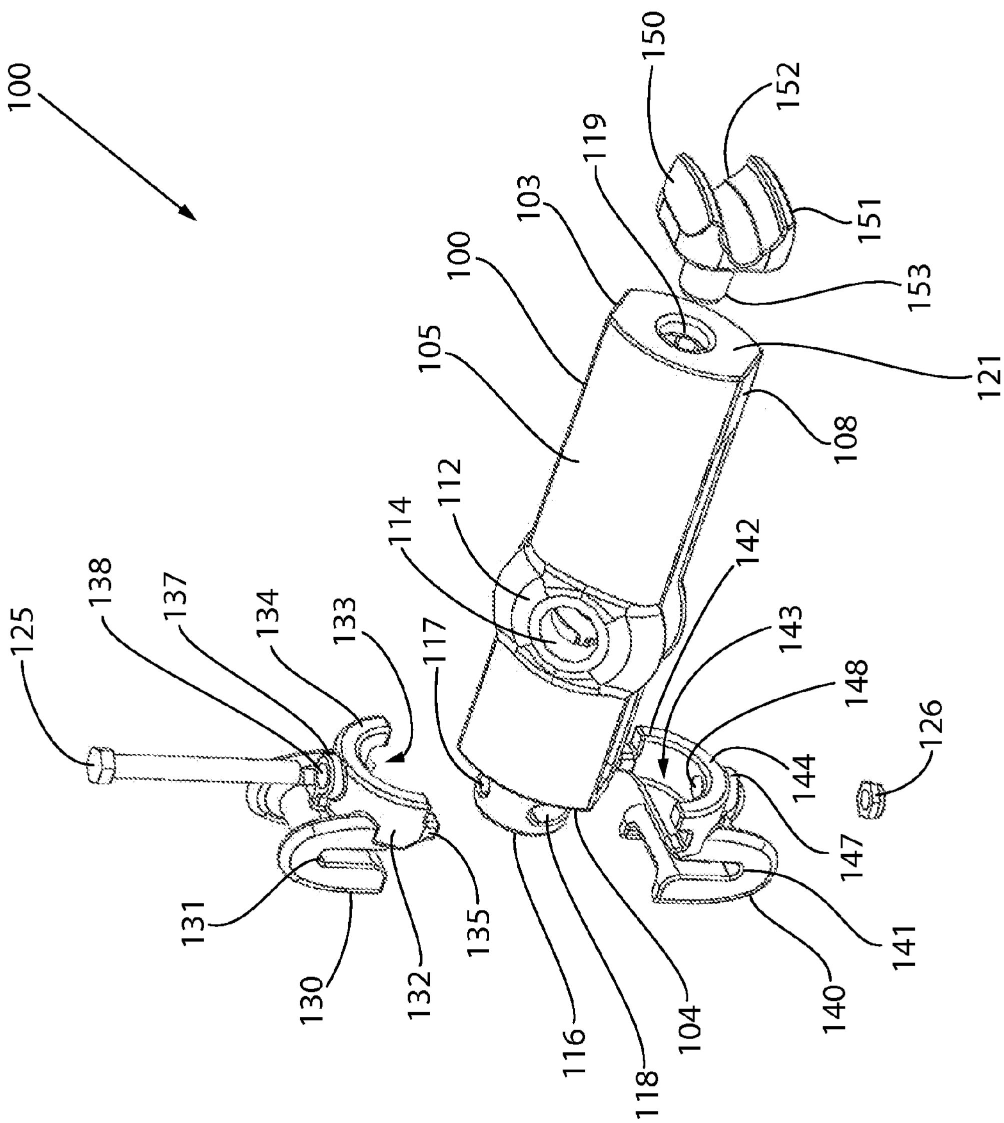
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FIG. 6

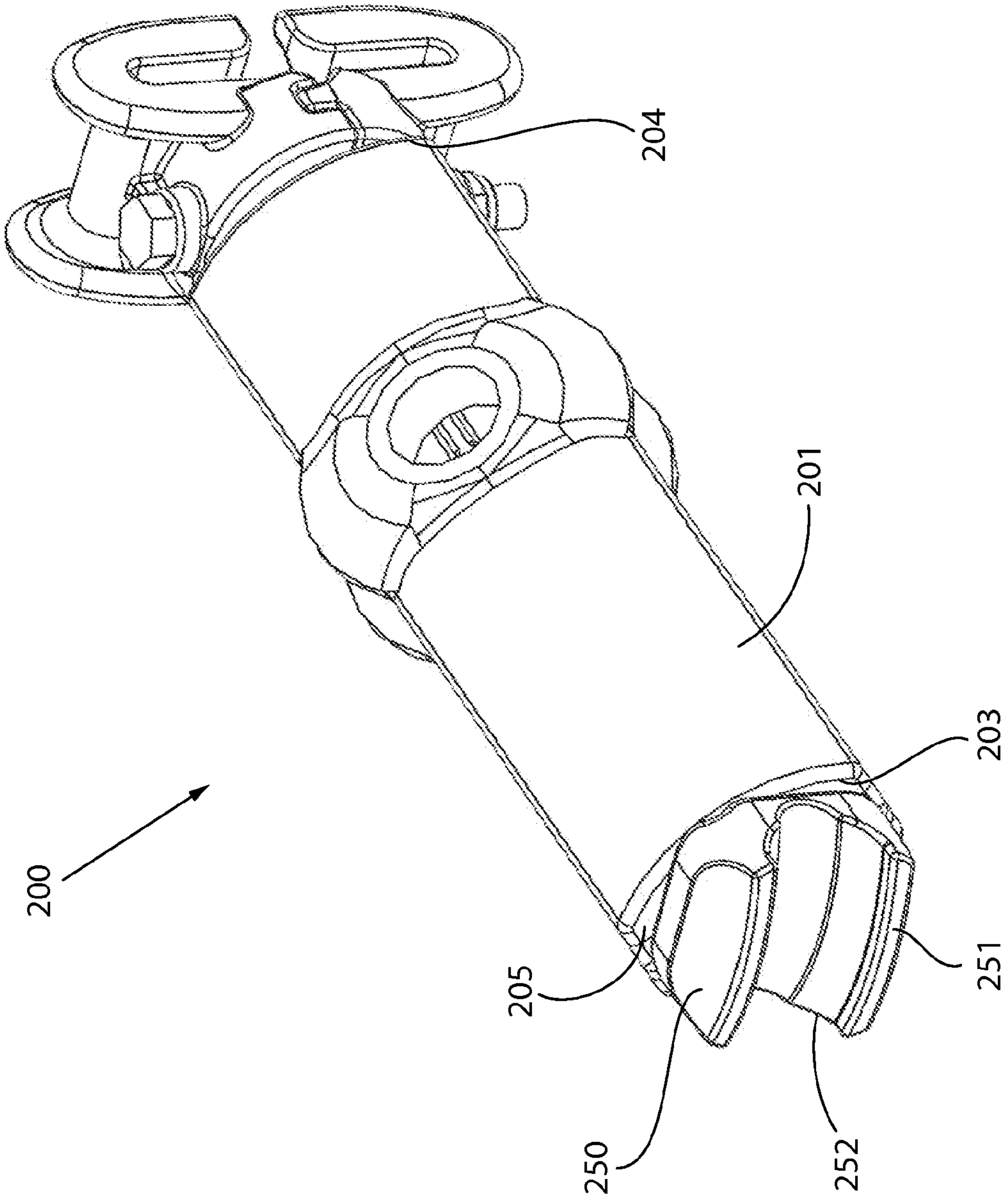


FIG. 7

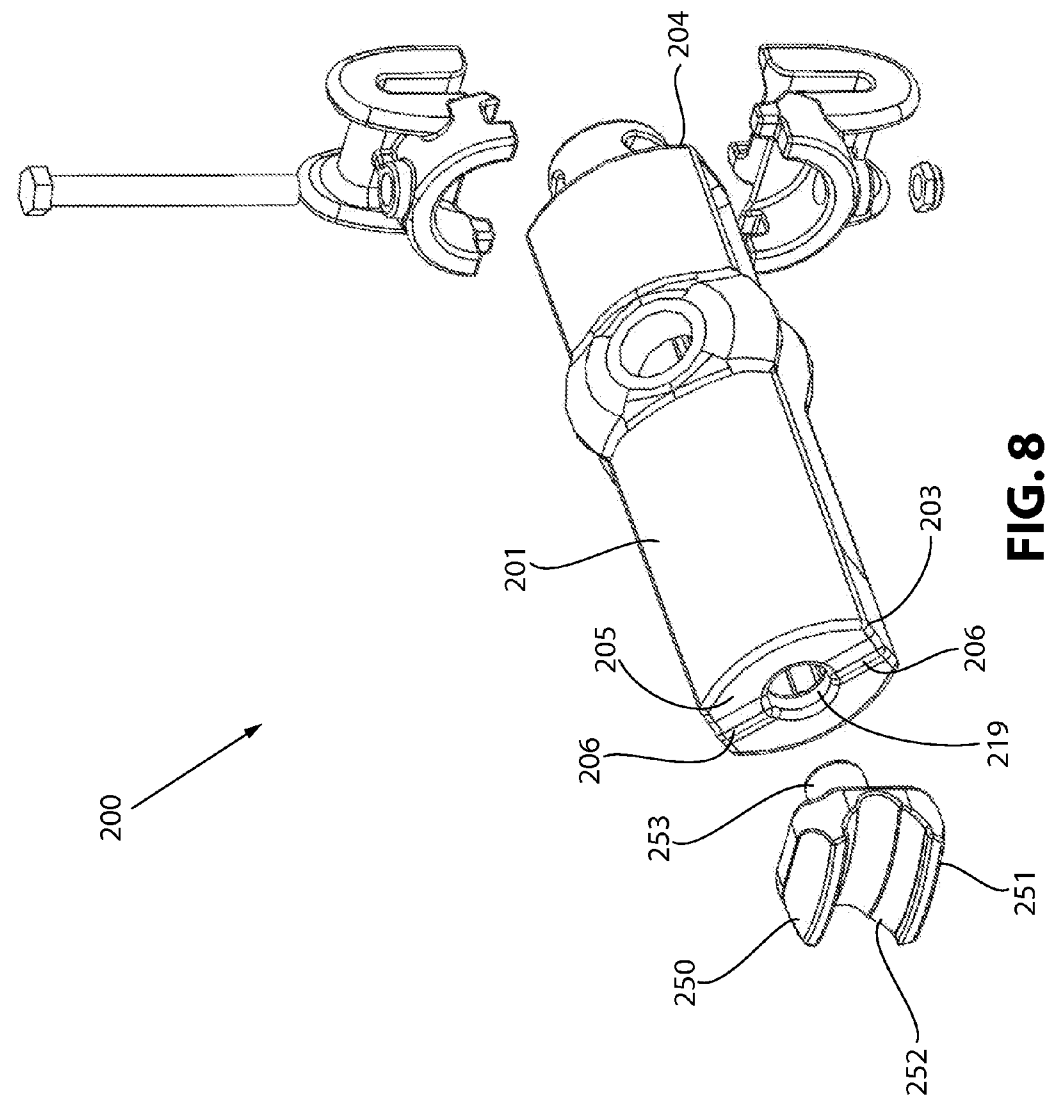
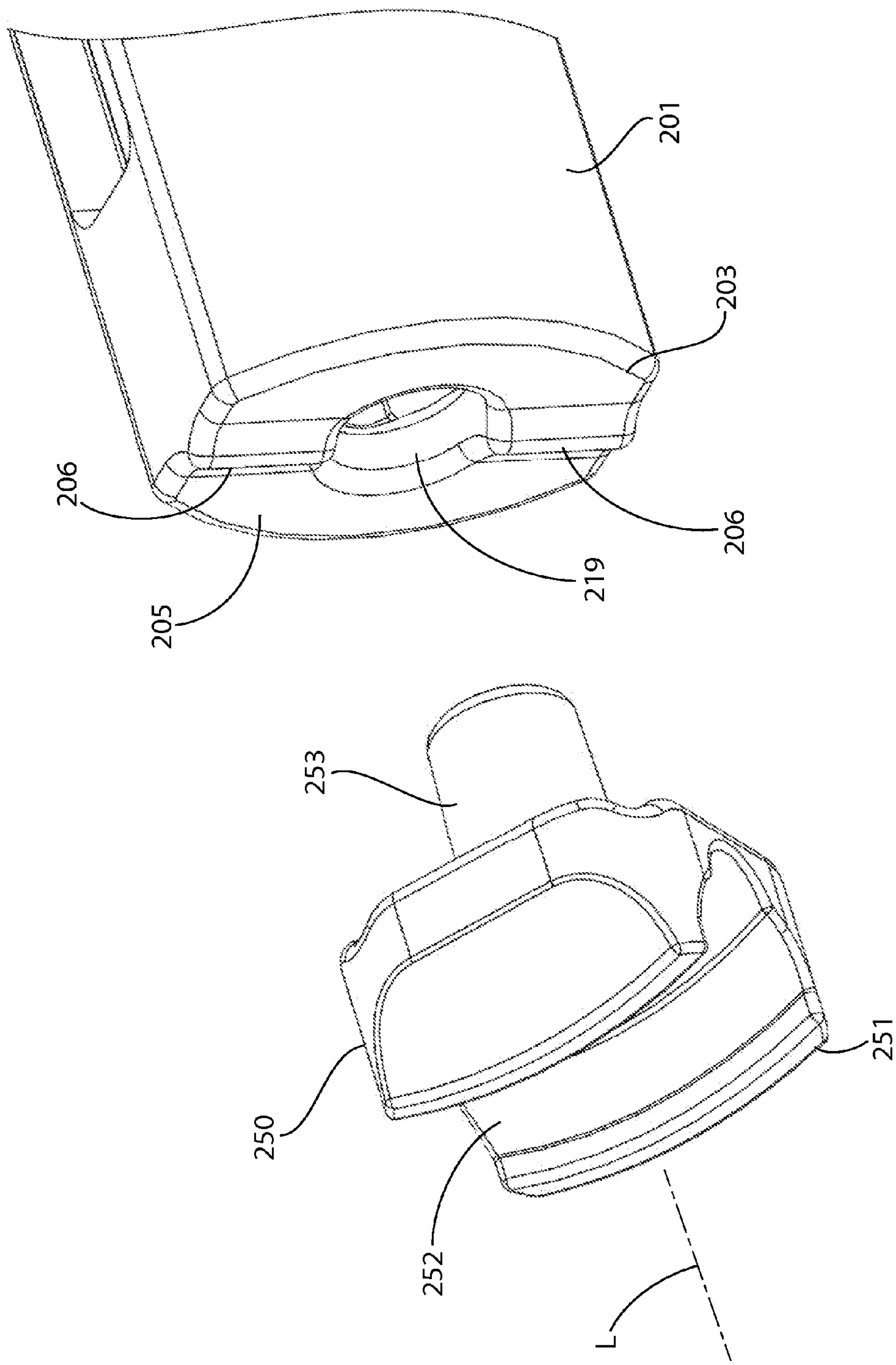


FIG. 8



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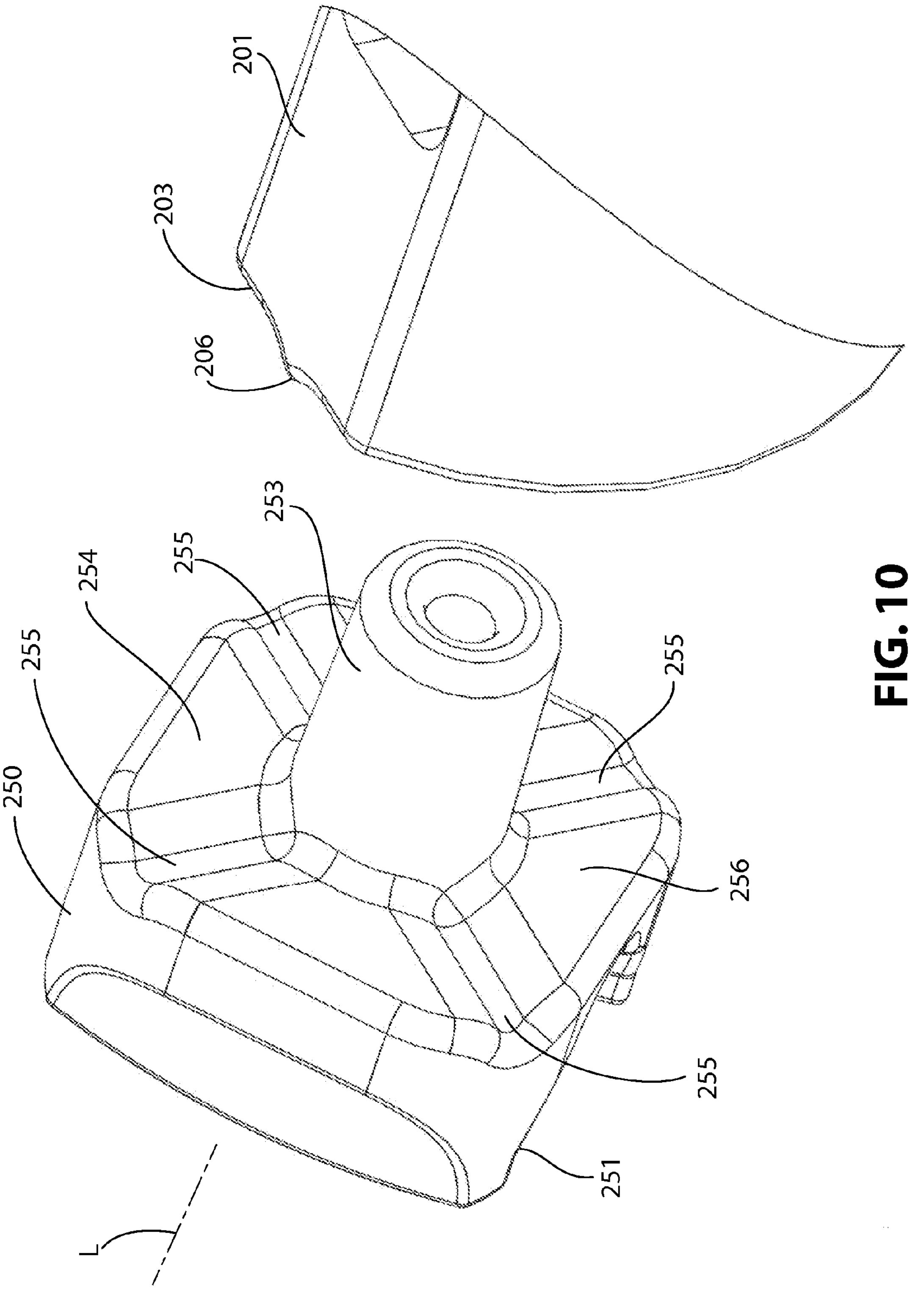

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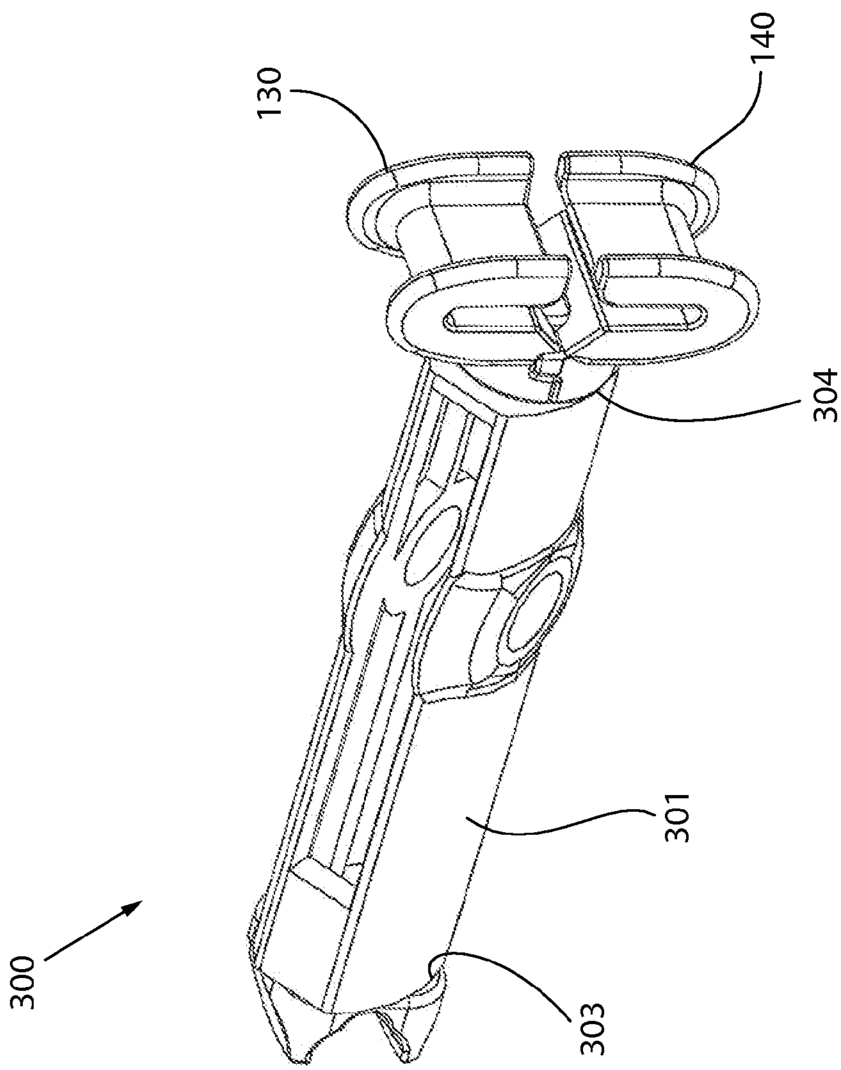

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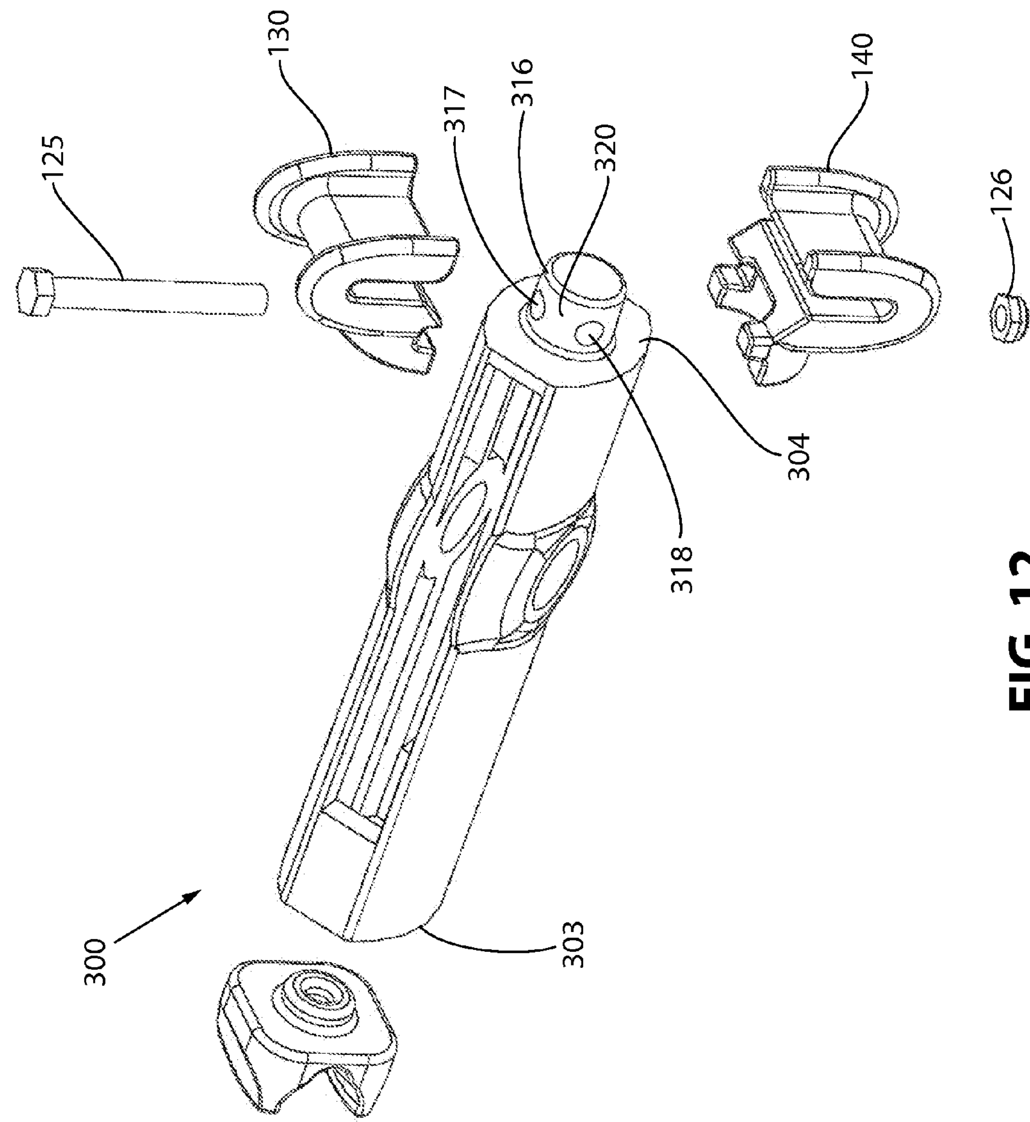
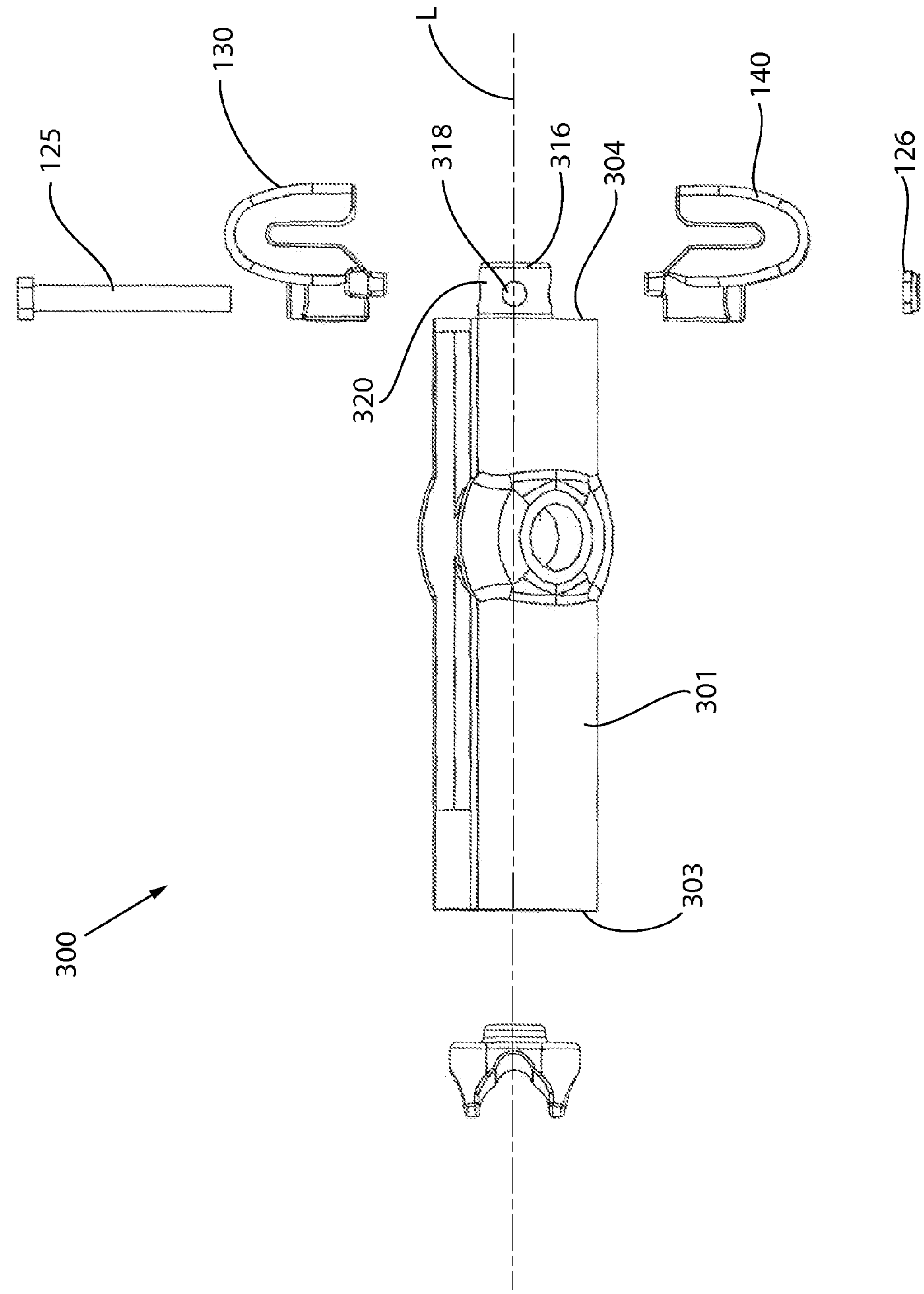


FIG. 12



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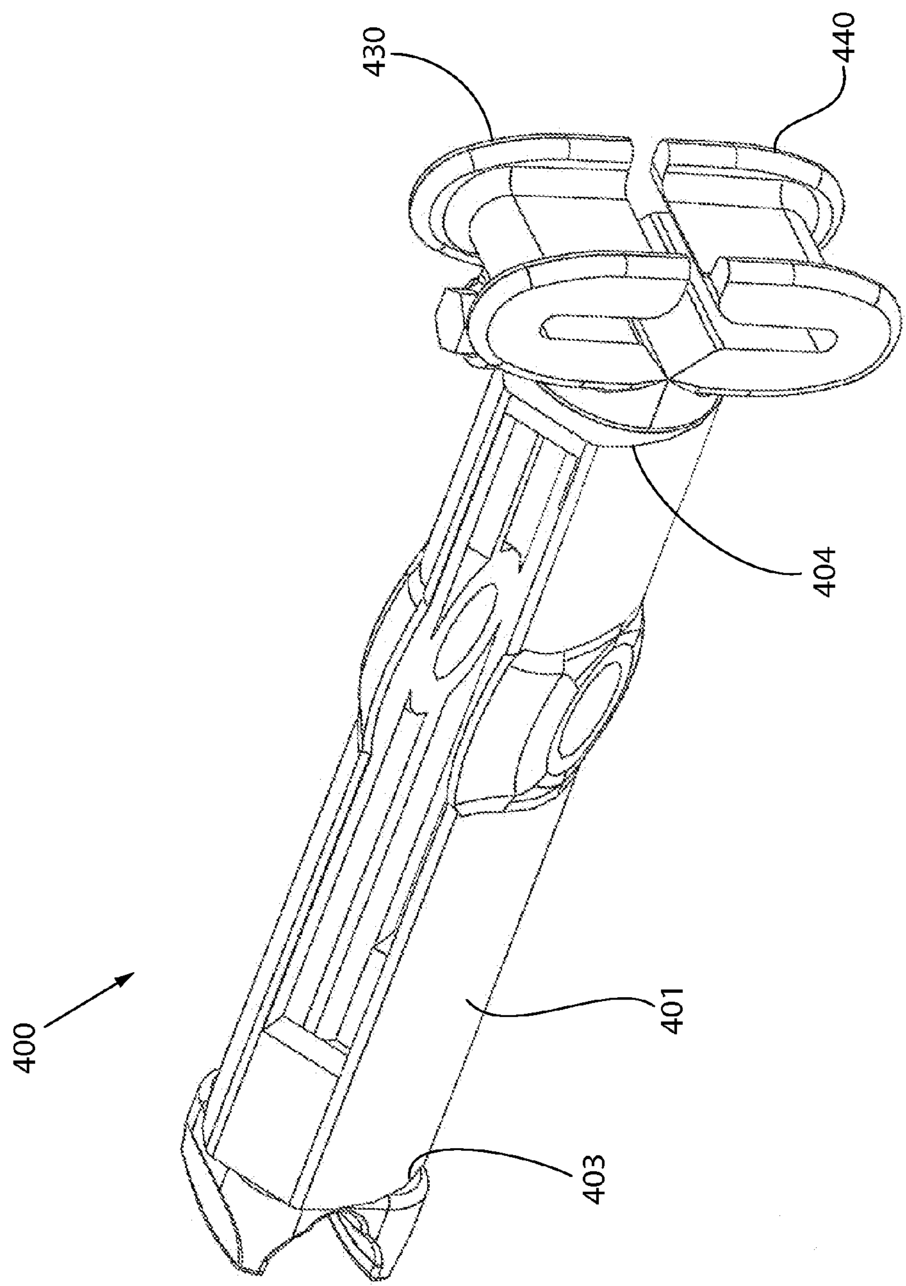

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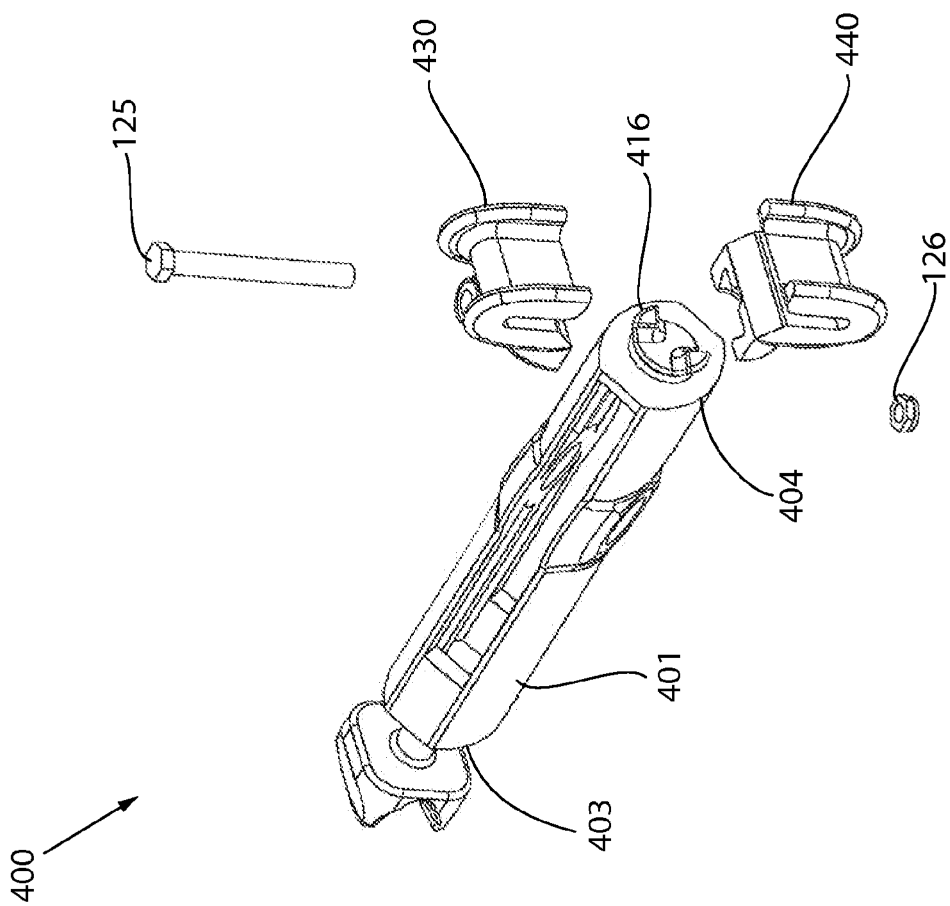

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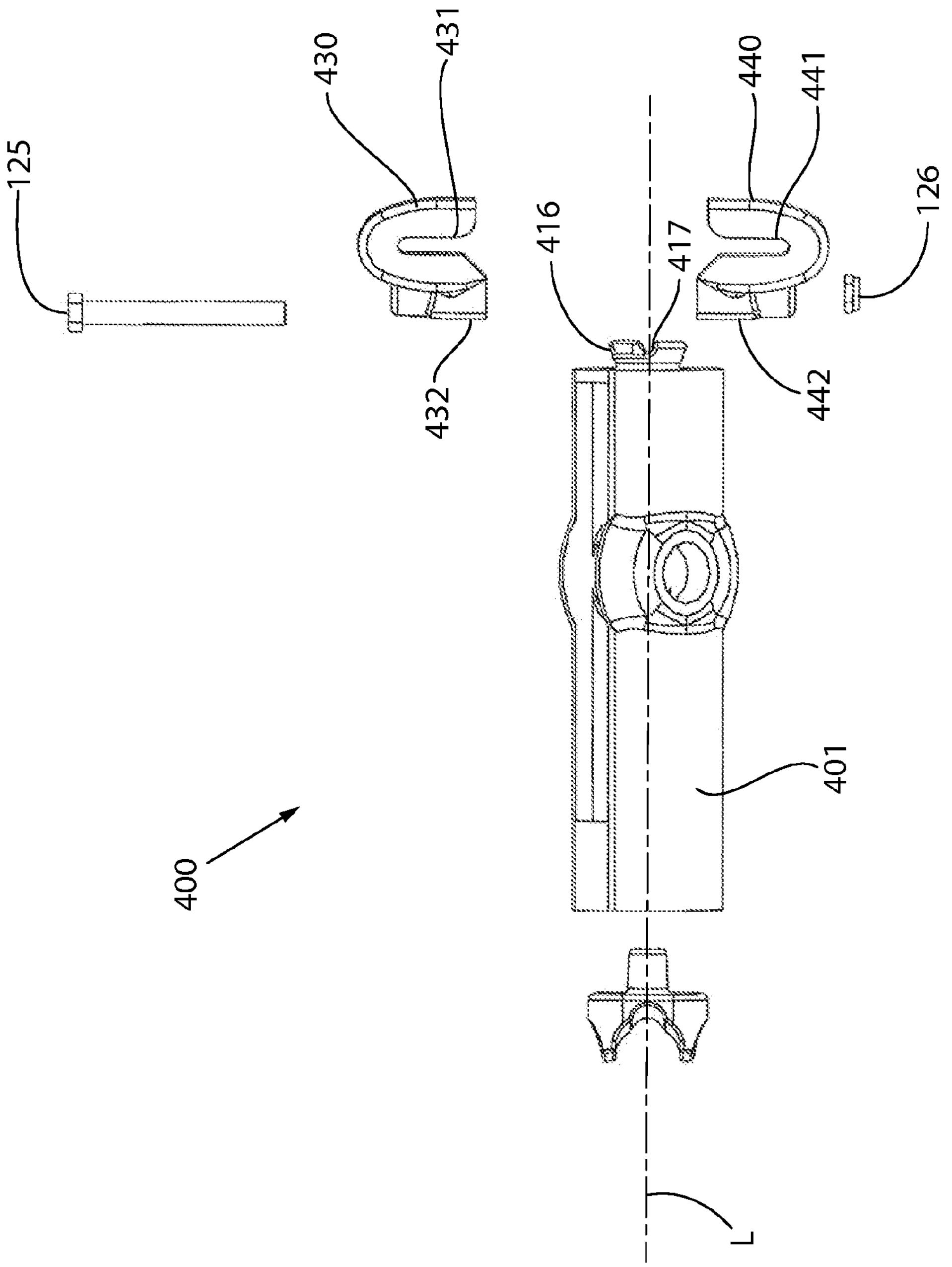

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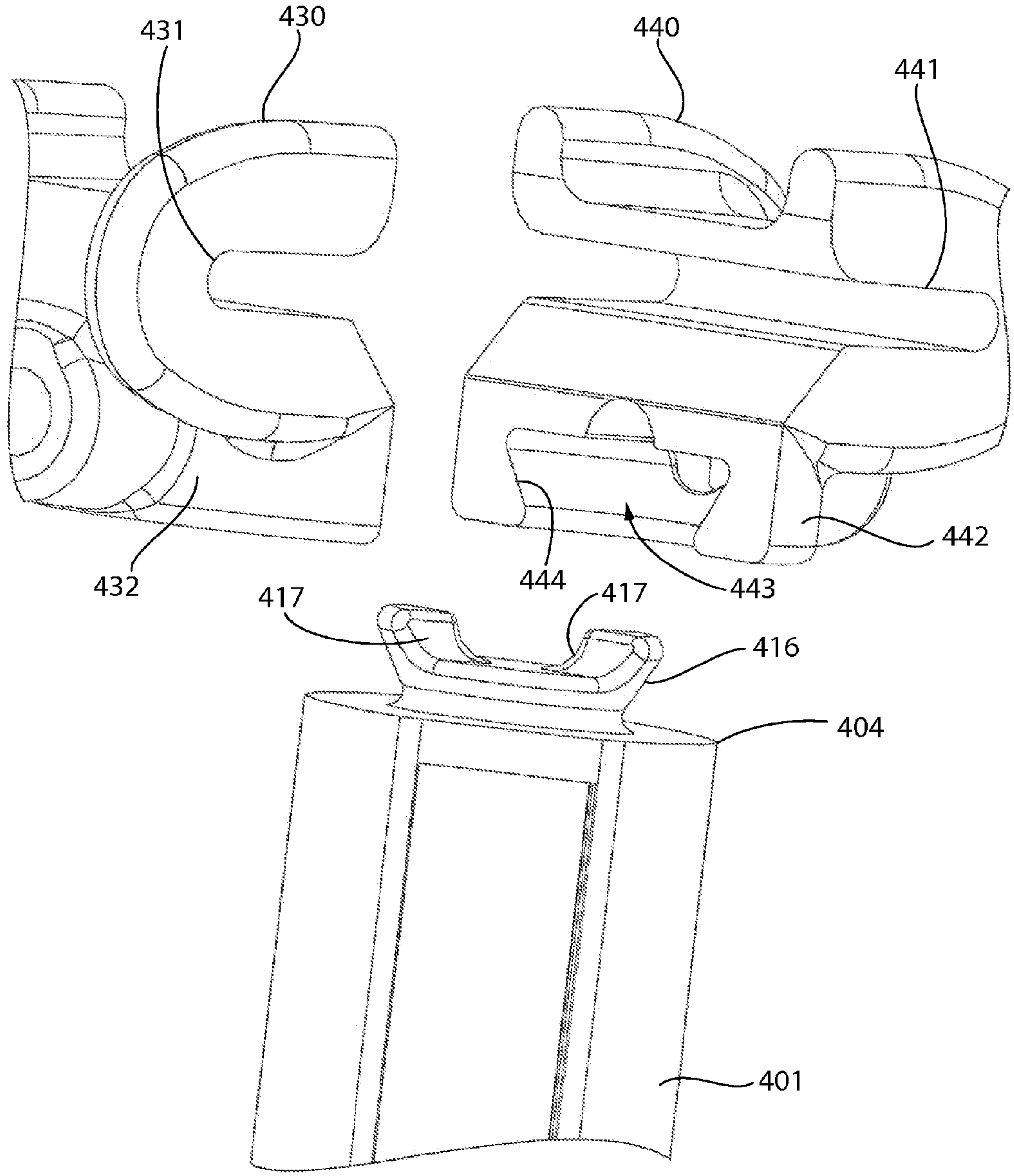

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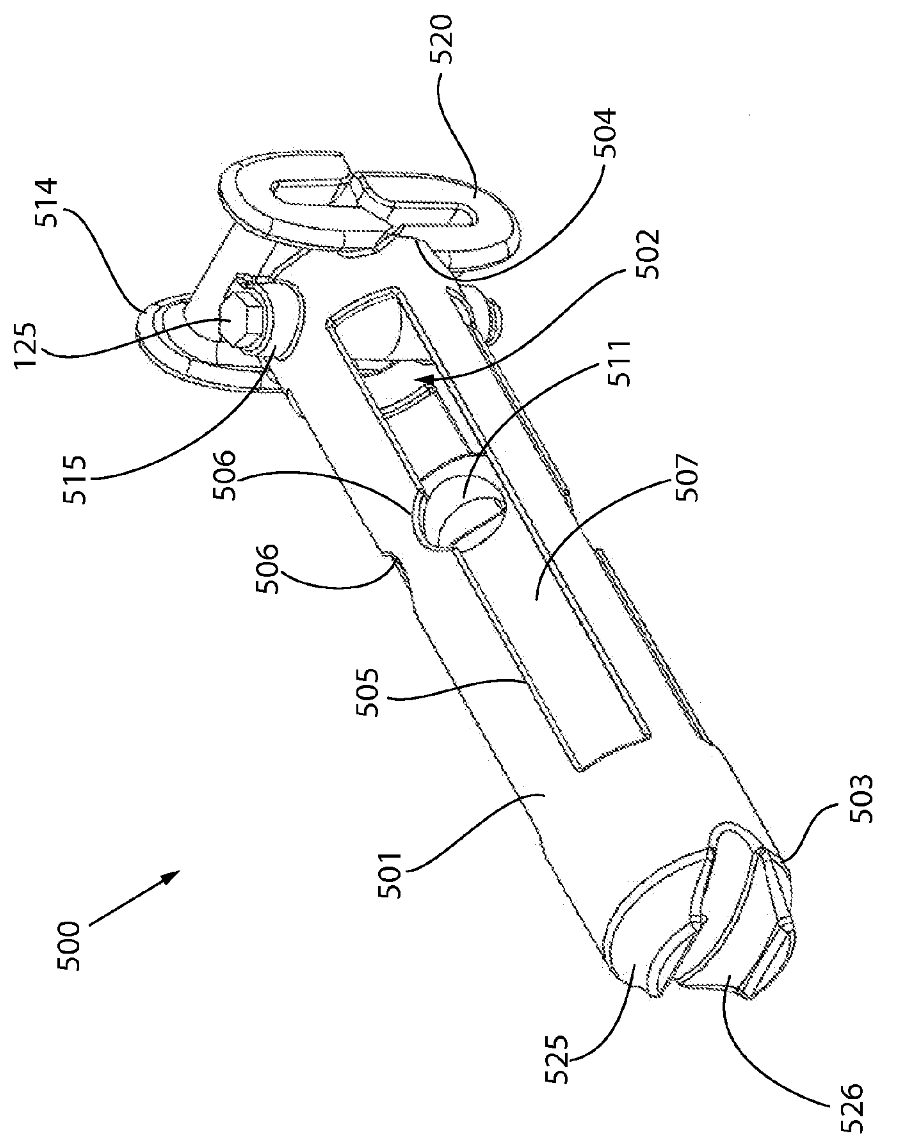

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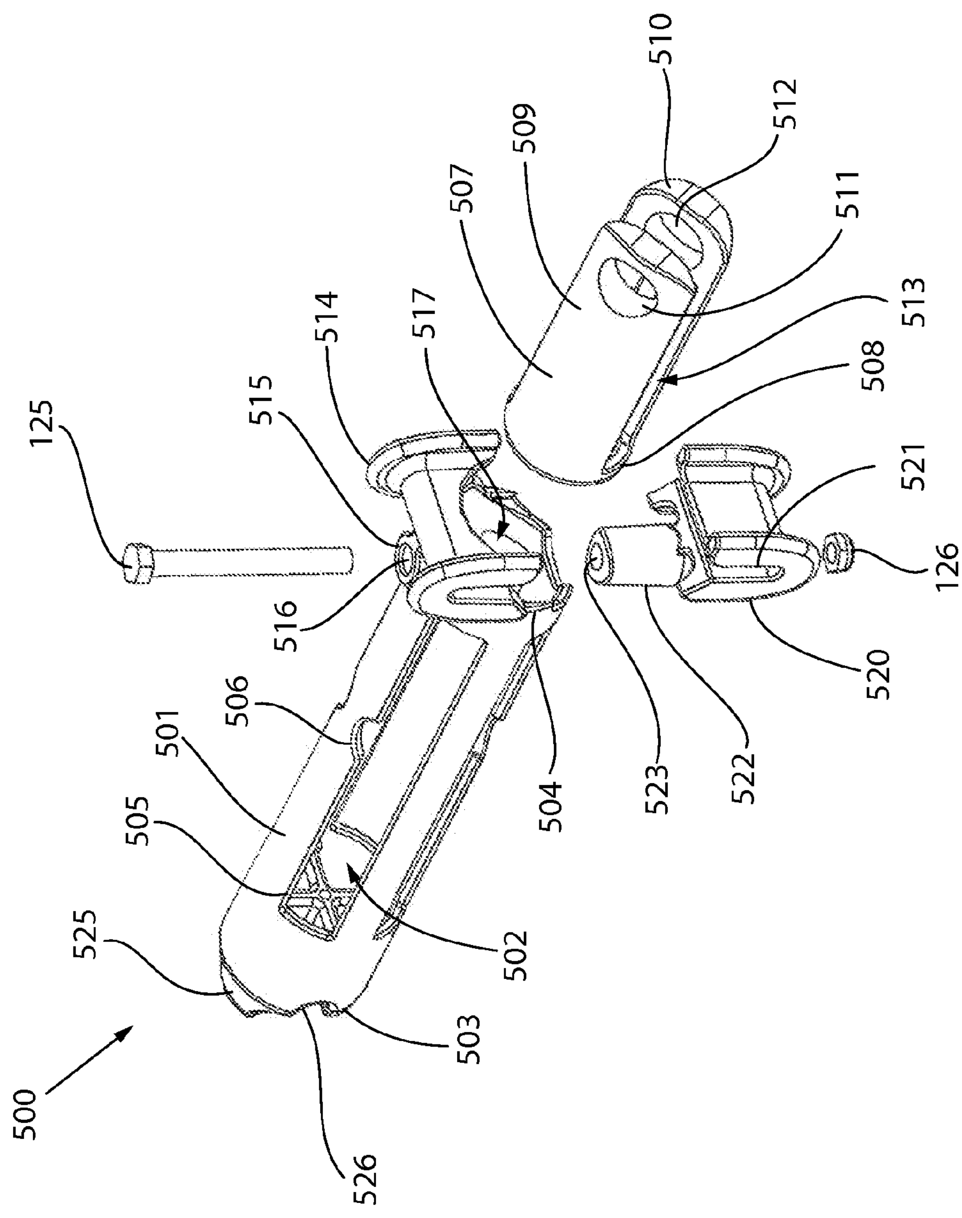
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FIG. 19

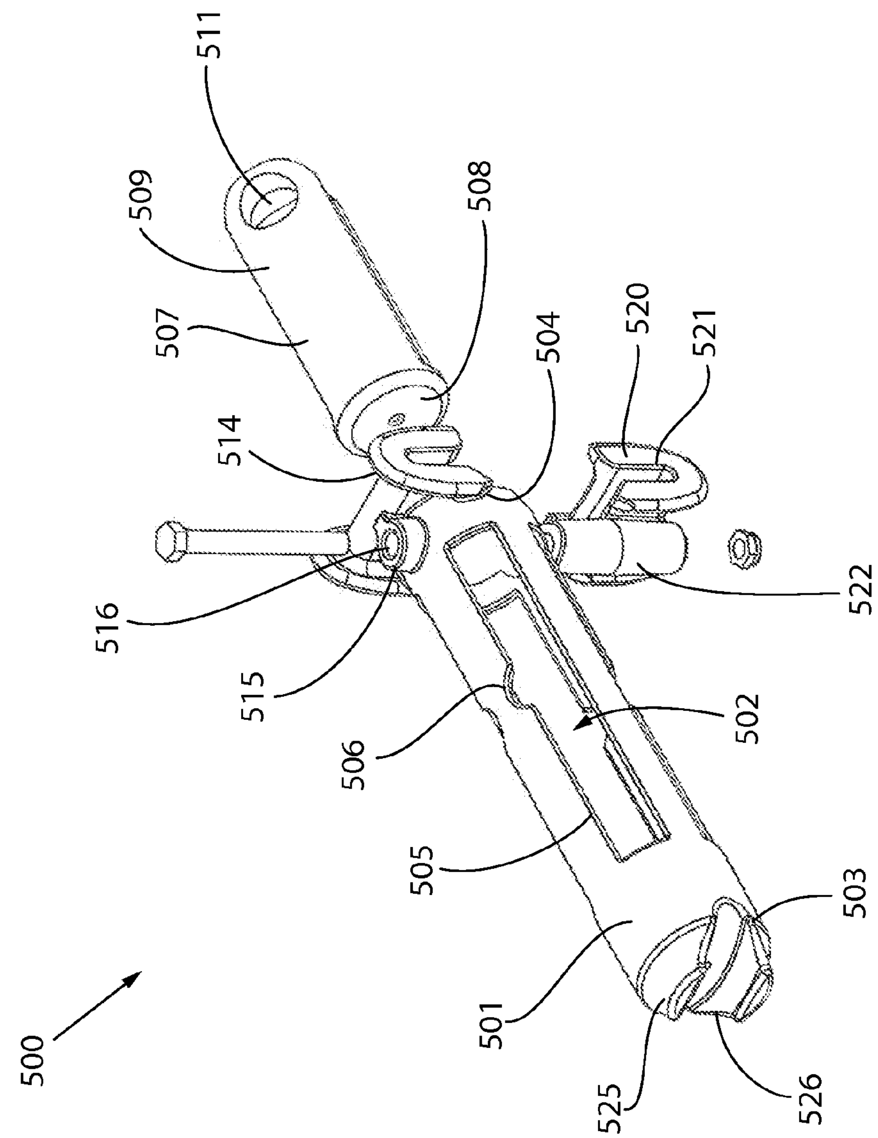
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FIG. 20

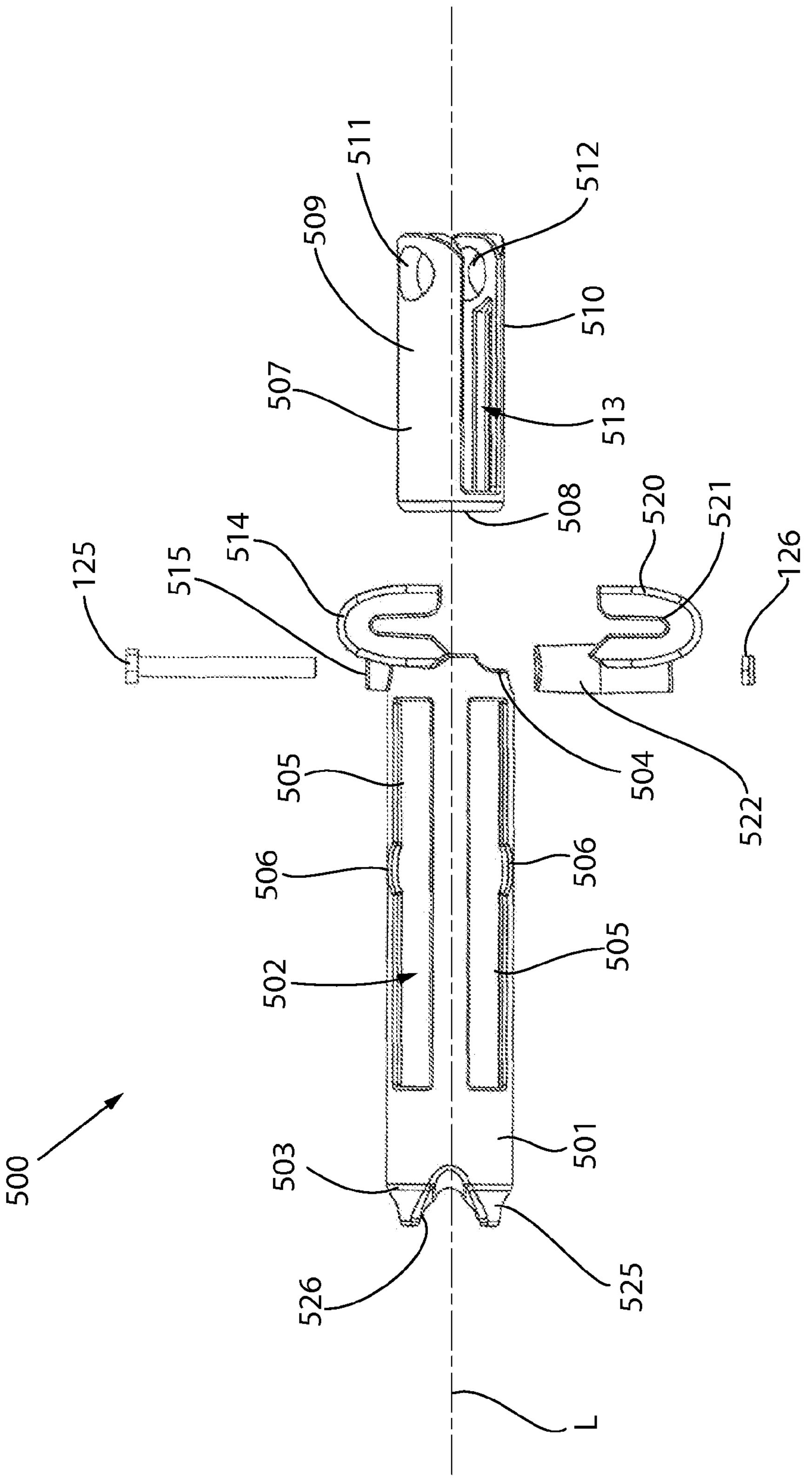

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FIG. 21

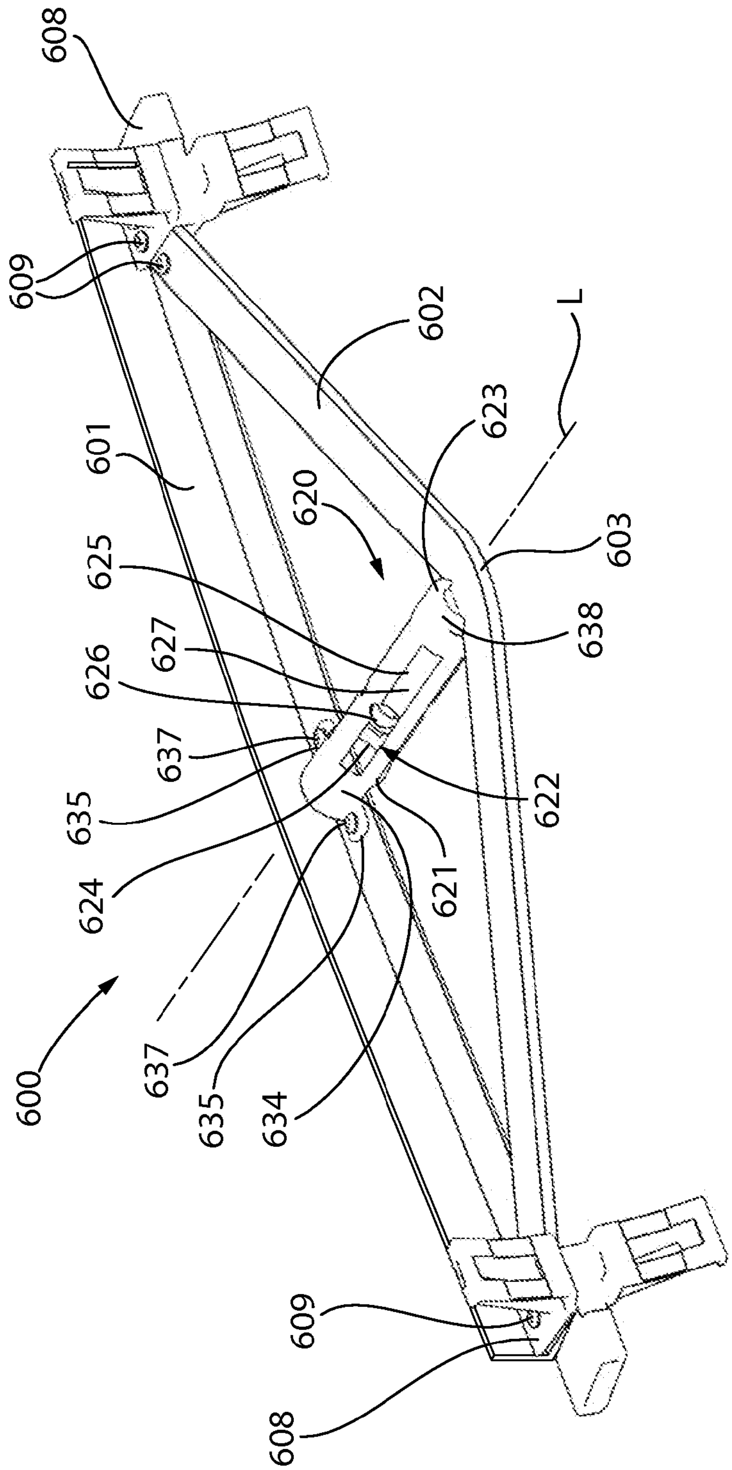
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FIG. 22

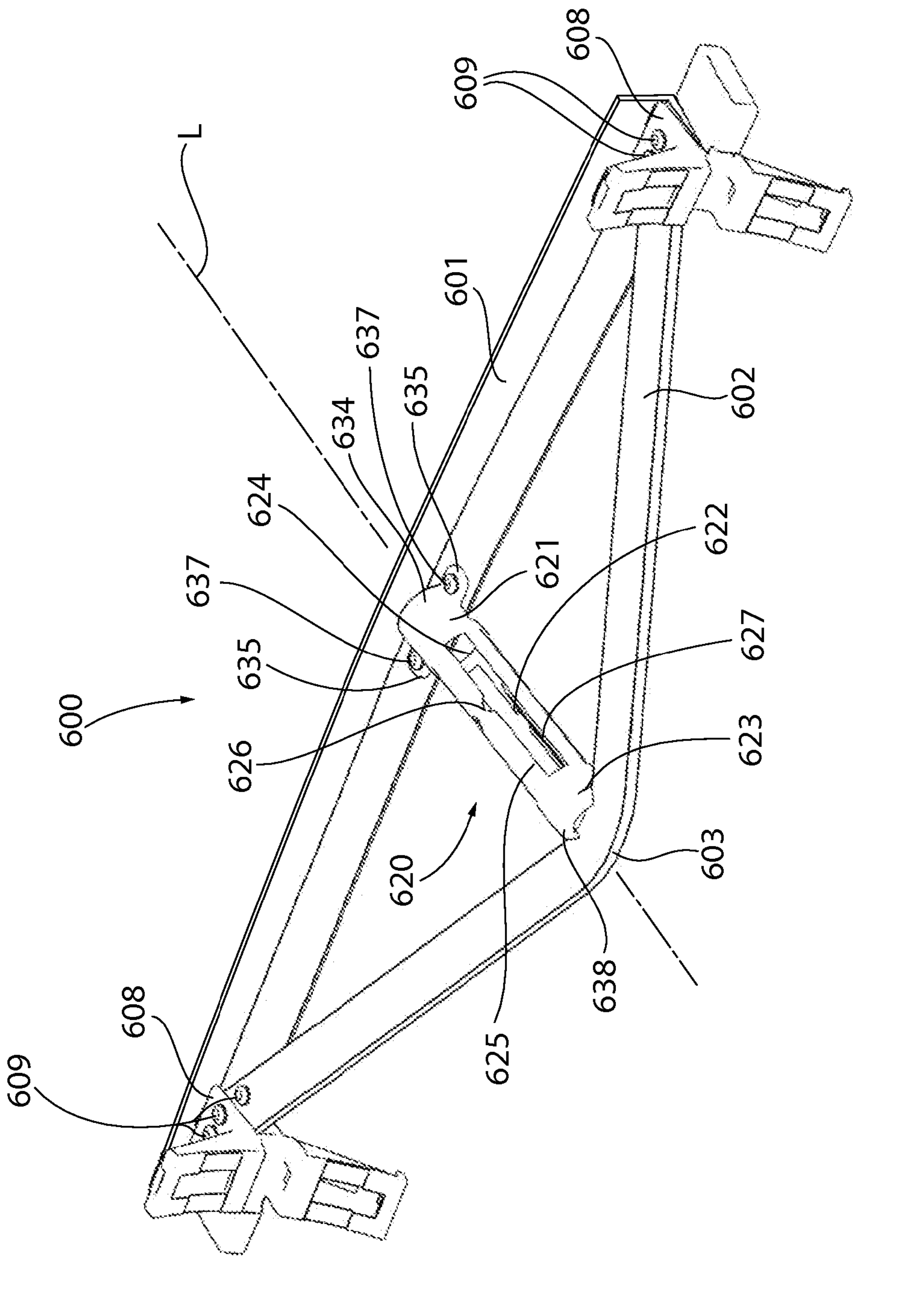
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FIG. 23

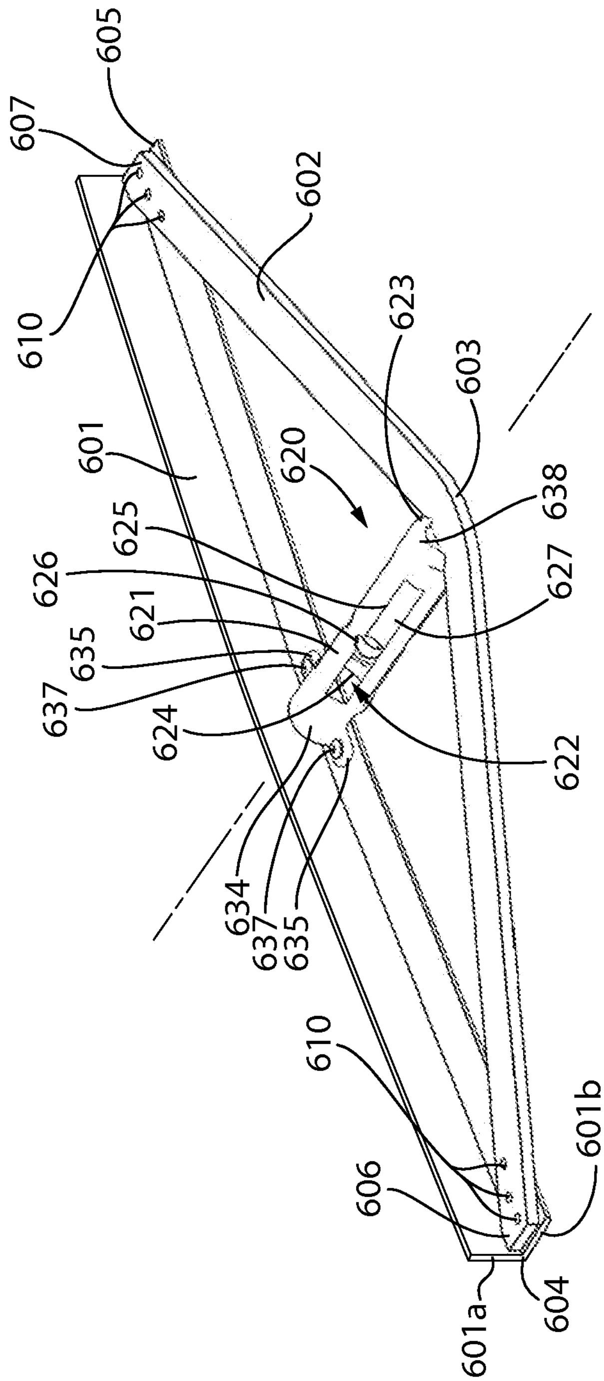
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FIG. 24

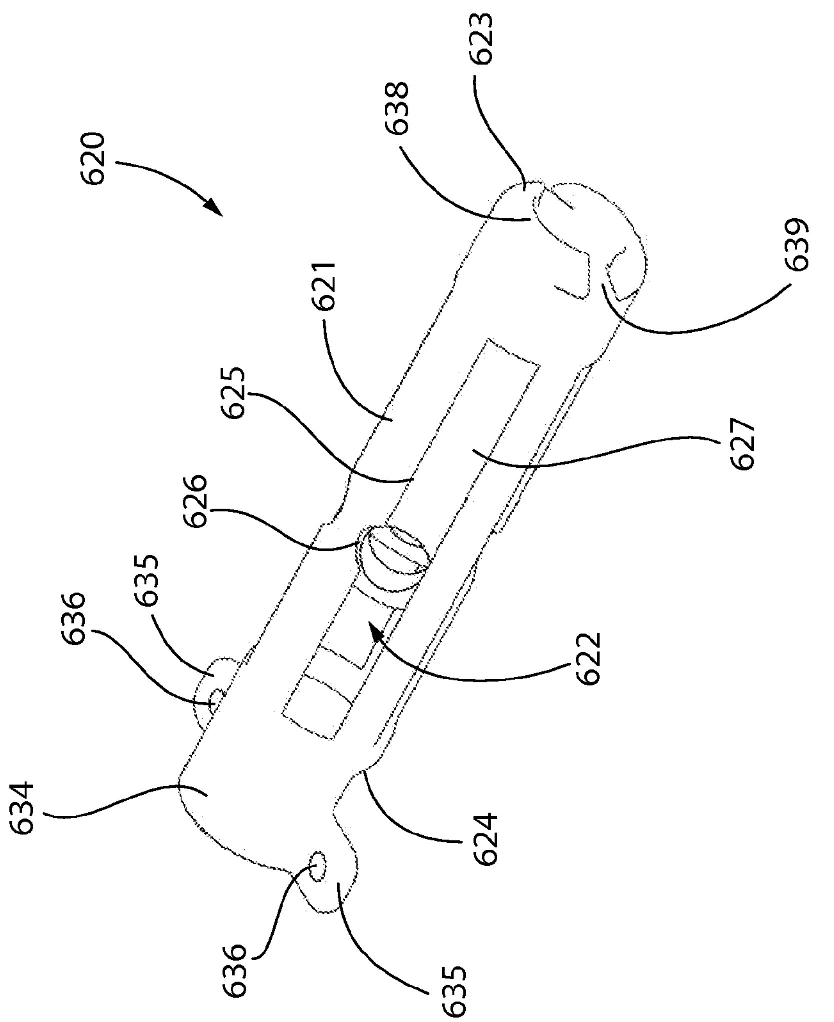

FIG. 25

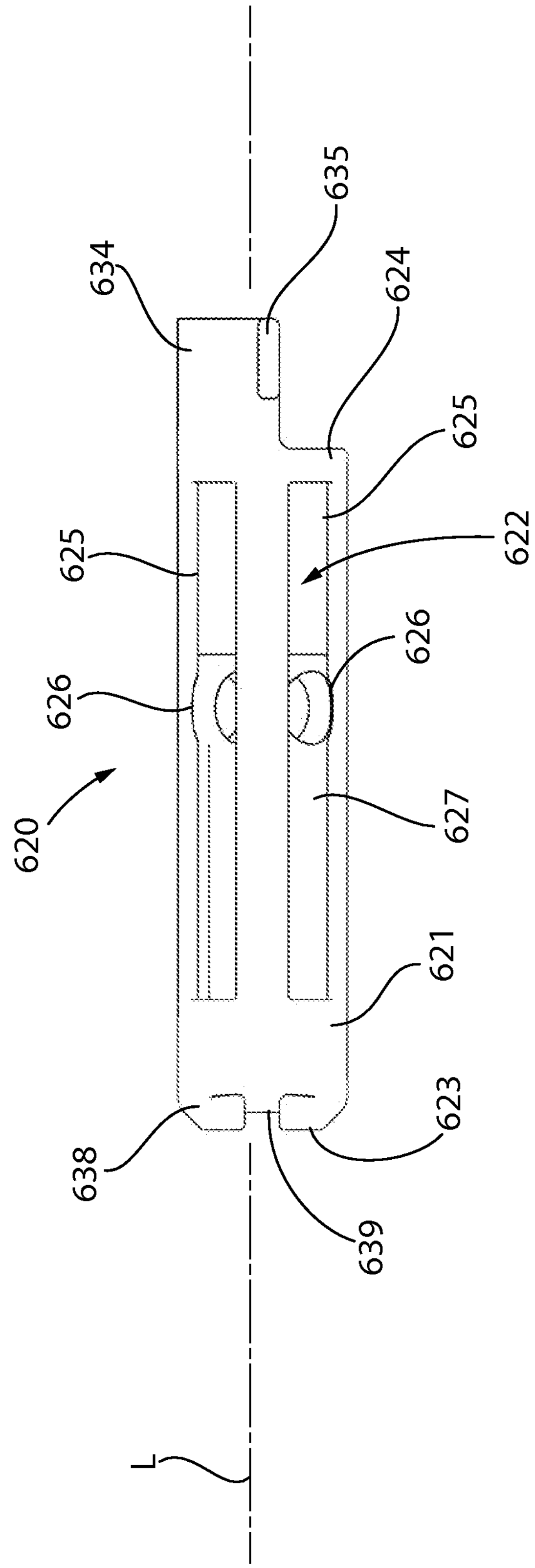

FIG. 26

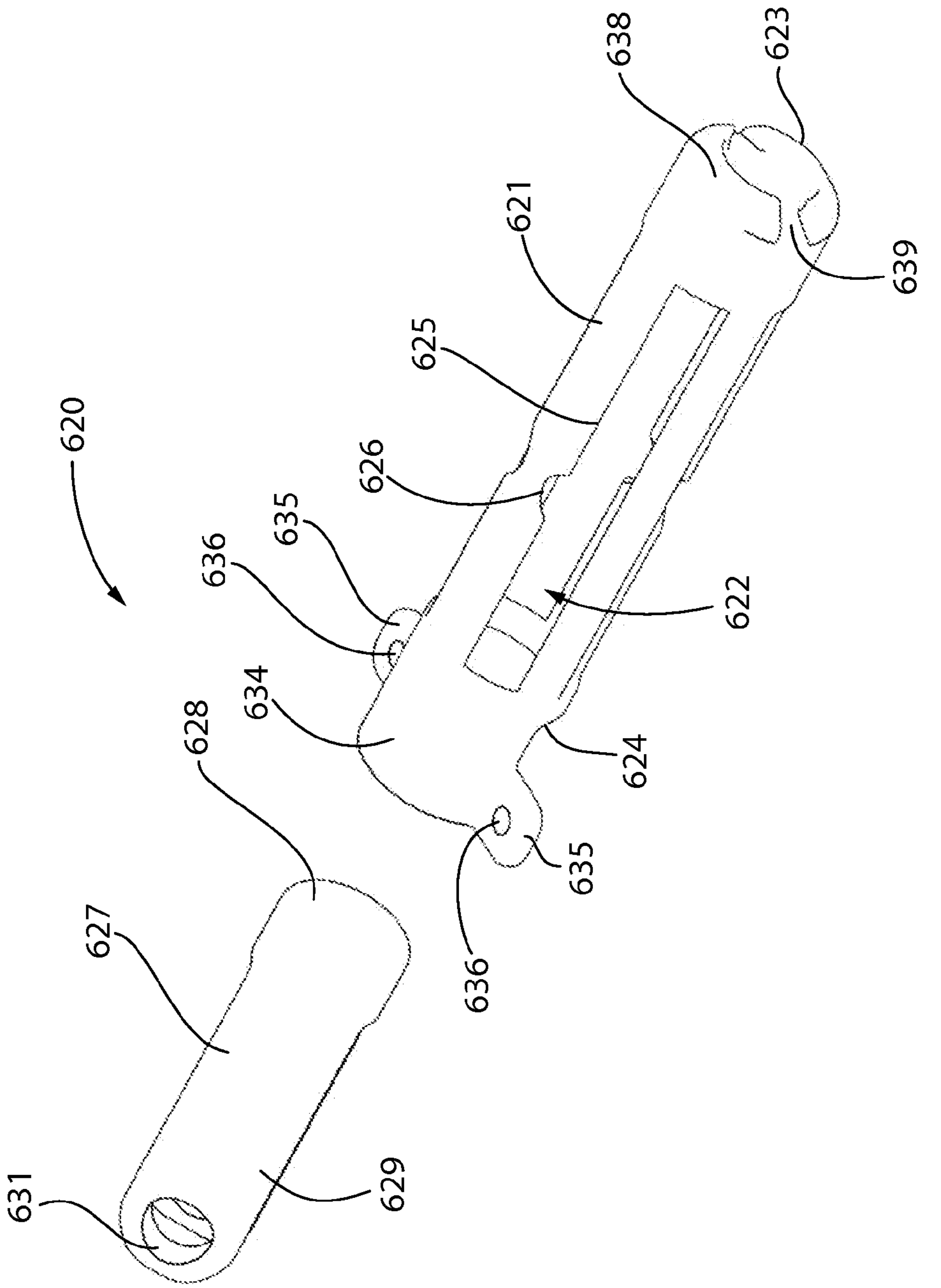
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FIG. 27

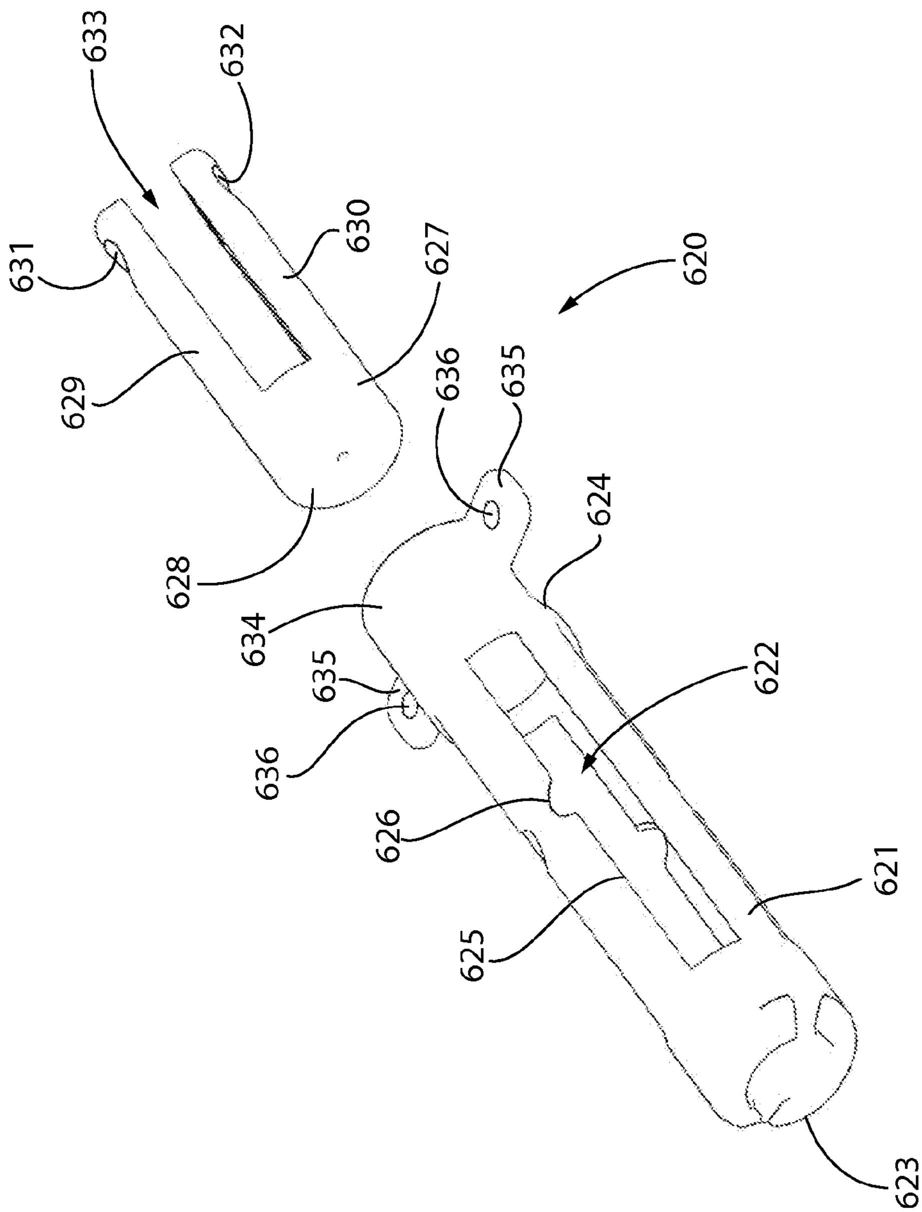
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FIG. 28

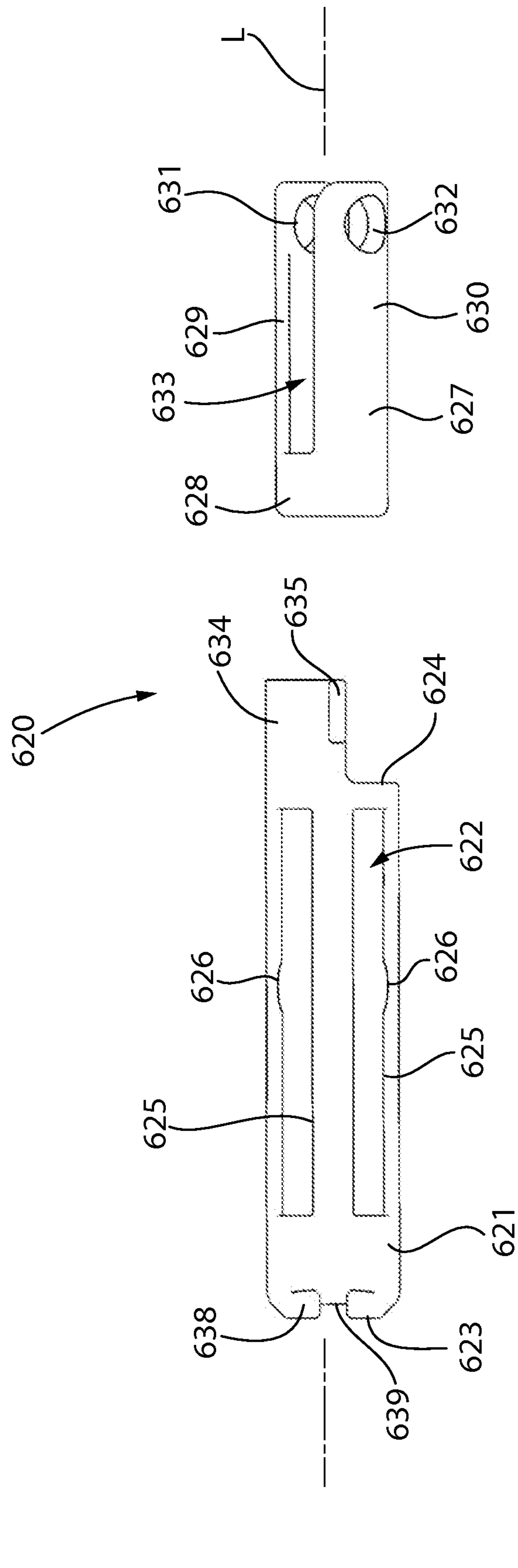
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FIG. 29

UNIVERSAL BRAKE BEAM STRUT

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present disclosure relates to a strut for mounting a brake lever of a brake actuator to a brake beam assembly in a railway car vehicle. In one embodiment, a reversible strut may be used to mount the brake lever on the brake beam assembly in a right-hand or left-hand configuration.

2. Description of Related Art

Railway freight cars typically include four brake beams, each associated with a particular set of wheels at the front or rear of the car. The brake beams are comprised of a compression member carrying brake shoes at the ends thereof and a V-shaped tension member. An air brake cylinder is mounted on the freight car and is associated with the brake beams by a brake rod that connects to a lever extending through a strut of the brake beam assembly, which extends between the compression member and the tension member. The brake shoes are applied to the wheels to slow the car by activating the air brake assembly to pull the brake rods, which actuate the lever to move the compression members in the direction of the wheels.

Such brake systems require that the brake lever extends through the strut at an angle with respect to a horizontal plane and, thus, during manufacture, the brake beam assembly is made in one of a right-hand or a left-hand configuration. Accordingly, railway operators are required to stock both right-hand and left-hand brake beam components for replacement and maintenance, contributing to greater input of material cost for keeping sufficient numbers of replacement supplies and greater storage and transportation needs. One solution to this problem has been to manually alter a brake beam by cutting a bolt connecting the strut to the compression and tension members, rotating the strut, and then re-securing the strut. This solution requires additional labor by the railway operator and may weaken the structural integrity of the brake beam assembly.

SUMMARY OF THE INVENTION

Accordingly, there is a general need in the art for a universal brake beam assembly, wherein the strut is connected between the compression member and the tension member to be easily rotatable and reversible in order to convert the brake beam assembly from a right-hand to a left-hand configuration without significant input of labor or disassembly and physical alteration of the brake beam assembly.

According to one embodiment, a reversible brake beam is provided, which utilizes a universal strut that can be rotated to be placed in either a right-hand or left-hand configuration without requiring removal of fasteners or other portions of the brake beam. This allows for easy modification of the brake beam assembly from a right-hand to a left-hand configuration, and vice versa, which cuts down on inventory for the railway operator and cuts down on component inventory for the manufacturer.

According to one particular embodiment, a strut for a brake beam assembly is provided. The strut includes a strut body extending along a longitudinal axis between a proximal end and a distal end, the strut body including at least one slot defined in the strut body configured to receive and support a brake lever extending through the strut body non-parallel to the longitudinal axis of the strut body, a compression member engager configured to connect the strut body to a compression member of the brake beam assembly, the compression member engager being connected to the distal end of the strut body, and a tension member engager configured to engage a tension member of the brake beam assembly, the tension member engager being connected to the proximal end of the strut body. A first portion of the strut body at least partially defining the proximal end of the strut body and the distal end of the strut body is non-rotatably connected to the compression member engager and the tension member engager. A second portion of the strut body at least partially defining the at least one slot is rotatable about the longitudinal axis of the strut body with respect to the compression member engager and the tension member engager such that the at least one slot may be oriented at opposing angles with respect to a horizontal plane extending through the longitudinal axis of the strut body.

According to another embodiment, a brake beam assembly is provided. The brake beam assembly includes a compression member having a first end and a second end, a tension member having a first end and a second end and a substantially V-shape defining an apex, the first and second ends of the tension member being connected to the first and second ends of the compression member, respectively, a strut extending between the compression member and the apex of the tension member, a brake head directly or indirectly connected to each of the first and second ends of the compression member and the tension member, and a brake shoe disposed on each of the brake heads. The strut includes a strut body extending along a longitudinal axis between a proximal end and a distal end, the strut body including at least one slot defined in the strut body configured to receive and support a brake lever extending through the strut body non-parallel to the longitudinal axis of the strut body, a compression member engager connecting the strut body to the compression member, the compression member engager being connected to the distal end of the strut body, and a tension member engager engaging the tension member at the apex, the tension member engager being connected to the proximal end of the strut body. A first portion of the strut body at least partially defining the proximal end of the strut body and the distal end of the strut body is non-rotatably connected to the compression member engager and the tension member engager. A second portion of the strut body at least partially defining the at least one slot is rotatable about the longitudinal axis of the strut body with respect to the compression member engager and the tension member engager such that the at least one slot may be oriented at opposing angles with respect to a horizontal plane defined by the first and second ends of the compression member and the apex of the tension member.

According to yet another embodiment, a strut for a brake beam assembly is provided. The strut includes a strut body extending along a longitudinal axis between a proximal end and a distal end, the strut body including at least one slot defined in the strut body configured to receive and support a brake lever extending through the strut body non-parallel to the longitudinal axis of the strut body, a compression member engager configured to connect the strut body to a compression member of the brake beam assembly, the compression member engager being connected to the distal end of the strut body, at least one fastener configured to engage the compression member engager to fasten the compression member engager on the compression member, and a tension member engager configured to engage a tension member of the brake beam assembly, the tension member engager being connected to the proximal end of the strut body. At least a portion of the strut body is rotatable about the longitudinal axis of the strut body with respect to the compression member engager and the tension member engager such that the at least one slot may be oriented at opposing angles with respect to a horizontal plane extending through the longitudinal axis of the strut body.

According to still yet another particular embodiment, a method of changing the orientation of a strut of a brake beam assembly is provided. The method includes the steps of providing a strut, the strut including a strut body, the strut body extending along a longitudinal axis between a proximal end and a distal end and including an engagement member at the distal end and at least one slot defined in the strut body configured to receive and support a brake lever extending through the strut body non-parallel to the longitudinal axis of the strut body, wherein at least a portion of the strut body is rotatable about the longitudinal axis of the strut body; a compression member engager configured to connect the strut body to a compression member of the brake beam assembly, the compression member engager being connected to the engagement member at the distal end of the strut body; and a tension member engager configured to engage a tension member of the brake beam assembly, the tension member engager being connected to the proximal end of the strut body; and rotating the at least a portion of the strut body in a direction about the longitudinal axis of the strut body with respect to the compression member engager and the tension member engager to orient the slot at an angle with respect to a horizontal plane extending through the longitudinal axis of the strut body.

The method may further include the step of rotating the at least a portion of the strut body in an opposing direction about the longitudinal axis of the strut body with respect to the compression member engager and the tension member engager to orient the slot at a reverse angle with respect to the horizontal plane. The angle may be 40° in the direction about the longitudinal axis and the reverse angle may be 40° in the opposing direction about the longitudinal axis.

Further details and advantages of the various embodiments, detailed herein, will become clear upon reviewing the following detailed description of the preferred embodiments in conjunction with the accompanying drawing figures.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a perspective view of a portion of a brake beam assembly in a first configuration according to one embodiment;

FIG. **2** is a perspective view of the portion of the brake beam assembly of FIG. **1** in a second configuration;

FIG. **3** is an upper distal perspective view of a strut for a brake beam assembly according to one embodiment;

FIG. **4** is an exploded upper distal perspective view of the strut of FIG. **3**;

FIG. **5** is an exploded side view of the strut of FIG. **3**;

FIG. **6** is an exploded upper proximal perspective view of the strut of FIG. **3**;

FIG. **7** is an upper proximal perspective view of a strut for a brake beam assembly according to another embodiment;

FIG. **8** is an exploded upper proximal perspective view of the strut of FIG. **7**;

FIG. **9** is a detailed exploded proximal perspective view of the strut of FIG. **7**;

FIG. **10** is a detailed exploded distal perspective view of the strut of FIG. **7**;

FIG. **11** is an upper distal perspective view of a strut for a brake beam assembly according to another embodiment;

FIG. **12** is an exploded upper distal perspective view of the strut of FIG. **11**;

FIG. **13** is an exploded side view of the strut of FIG. **11**;

FIG. **14** is an upper distal perspective view of a strut for a brake beam assembly according to another embodiment;

FIG. **15** is an exploded upper distal perspective view of the strut of FIG. **14**;

FIG. **16** is an exploded side view of the strut of FIG. **14**;

FIG. **17** is a detailed exploded distal perspective view of the strut of FIG. **14**;

FIG. **18** is an upper proximal perspective view of a strut for a brake beam assembly according to another embodiment;

FIG. **19** is an exploded upper distal perspective view of the strut of FIG. **18**;

FIG. **20** is an exploded upper proximal perspective view of the strut of FIG. **18**;

FIG. **21** is an exploded side view of the strut of FIG. **18**;

FIG. **22** is a first perspective view of a brake beam assembly according to another embodiment;

FIG. **23** is a second perspective view of the brake beam assembly of FIG. **22**;

FIG. **24** is a third perspective view of the brake beam assembly of FIG. **22** with the brake heads removed;

FIG. **25** is an upper proximal perspective view of a strut for a brake beam assembly according to another embodiment;

FIG. **26** is a side view of the strut of FIG. **25**;

FIG. **27** is an exploded upper proximal perspective view of the strut of FIG. **25**;

FIG. **28** is another exploded upper proximal perspective view of the strut of FIG. **25**; and

FIG. **29** is an exploded side view of the strut of FIG. **25**.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

For purposes of the description hereinafter, spatial orientation terms, as used, shall relate to the referenced embodiment as it is oriented in the accompanying drawing figures or otherwise described in the following detailed description. However, it is to be understood that the embodiments described hereinafter may assume many alternative variations and configurations. It is also to be understood that the specific components, devices, and features illustrated in the accompanying drawing figures and described herein are simply exemplary and should not be considered as limiting.

The term "proximal" as used hereinafter throughout the description and in the claims is the direction along a longitudinal axis of the strut oriented toward the tension member of a brake beam assembly and the term "distal" as used hereinafter throughout the description and in the claims is the direction along the longitudinal axis of the strut oriented toward the compression member of the brake beam assembly.

With reference to FIGS. **1** and **2**, a portion of a brake beam assembly **10** is shown according to one embodiment. The portion of the brake beam assembly **10** includes a compression member **11** having a first end **12** and a second end **13**, and a tension member **14** having a first end **16**, a second end **17**, and a substantially V-shape defining an apex **15**. The first end **16** and the second end **17** of the tension member **14** are connected to the first end **12** and the second end **13** of the compression member **11**, respectively. A strut **20** extends between the compression member **11** and the apex **15** of the tension member **14**. The strut **20** includes a strut body **21** that has a slot **24** defined therein that receives and supports a brake lever **18** of a brake actuator assembly, which extends through the strut body **21** non-parallel to a longitudinal axis L of the strut body **21**. The strut **20** also includes a compression member engager **22** connected to the distal end of the strut body **21**, which connects the strut body **21** to the compression member **11**, and a tension member engager **23** connected to the proximal end of the strut body **21**, which engages the tension member **14** at the apex **15**. At least a portion of the strut body **21** is rotatable about the longitudinal axis L of the strut body **21** with respect to the compression member engager **22** and the tension member engager **23** such that the slot **24** may be oriented at opposing angles with respect to a horizontal plane defined by the first end **12** and the second end **13** of the compression member **11** and the apex **15** of the tension member **14**, which bisects the compression member **11** and the tension member **14** at the ends **12**, **13**, **16**, **17** and at the apex **15** of the tension member **14**. Accordingly, the brake lever **18** retained within the slot **24** will also be oriented at one of the opposing angles such that the brake lever **18** can be positioned in a right-hand configuration or a left-hand configuration depending upon the need for one configuration or the other as a replacement part.

It is to be appreciated that, while not specifically illustrated, the portion of the brake beam assembly **10** shown in FIGS. **1** and **2** would also include a brake head directly or indirectly connected to each of the first ends **12**, **16** and the second ends **13**, **17** of the compression member **11** and the tension member **14** and a brake shoe disposed on each of the brake heads as is well known to those having ordinary skill in the art.

As shown in FIGS. **1** and **2**, the portion of the strut body **21** is rotatable to orient the slot **24** at opposing angles of about 40° with respect to the horizontal plane defined by the ends **12**, **13** of the compression member **11** and the apex **15** of the tension member **14**. Accordingly, the portion of the strut body **21** is rotatable at least 80° about the longitudinal axis L of the strut body **21** such that the slot **24** can receive the brake lever **18** at one of the two opposing 40° angles with respect to the horizontal plane illustrated in FIGS. **1** and **2**.

With reference to FIGS. **3-6**, a strut **100**, for use as the strut **20** in the assembly shown in FIGS. **1** and **2**, is shown according to another embodiment. The strut **100** includes a strut body **101** extending along a longitudinal axis L between a proximal end **103** defined by a proximal wall and a distal end **104** defined by a distal wall. The strut body **101** has an internal cavity **102**, which extends from the proximal end **103** to the distal end **104** of the strut body **101**, defined therein by the inner surface of a wall of the strut body **101**. Elongated openings **109**, **110** are provided in respective lateral sides **107**, **108** of the strut body **101**. The elongated openings **109**, **110** place the exterior of the strut body **101** in communication with the internal cavity **102** to define at least one slot **111**, in particular a single slot **111**, in the strut body **101**, which is configured to receive and support a brake lever extending through the strut body **101** non-parallel to the longitudinal axis L of the strut body **101**. Additionally, the strut body **101** includes an upper side **105** and a lower side **106**. The upper side **105** and the lower side **106** each include a respective raised and contoured surface **112**, **113**. The raised and contoured surface **112** on the upper side **105** includes a hole **114** defined therein extending through the strut body **101** to the internal cavity **102**. The raised and contoured surface **113** on the lower side **106** includes a hole **115** defined therein extending through the strut body **101** to the internal cavity **102**. The holes **114**, **115** are aligned to oppose each other and extend perpendicular to and intersect with the slot **111**. The holes **114**, **115** are configured to receive a fastener (not shown) that can be passed through the strut body **101** to connect and pivotably support a brake lever on the strut body **101** in the slot **111**. The raised and contoured surfaces **112**, **113** provide support for the fastener and increase the material strength of the strut body **101** at the location of the fastener.

The strut **100** also includes a compression member engager that includes a clamp made up of a first clamp member **130** and a second clamp member **140**, which are configured to connect the strut body **101** to a compression member of the brake beam assembly, and a tension member engager **150**, which is connected to the proximal end **103** of the strut body **101** and is configured to engage a tension member of the brake beam assembly.

As shown in FIGS. **4-6**, the strut body **101** includes an engagement member **116** positioned at the distal end **104** of the strut body **101**. The engagement member **116** is provided to connect the clamp made up of the first clamp member **130** and the second clamp member **140** to the distal end **104** of the strut body **101**. The engagement member **116** is a hollow cylindrical member defined by a cylindrical wall **120** extending from distal end **104** of the strut body **101**. The engagement member **116** includes two opposing and elongated slots **117**, **118**, which are defined in the cylindrical wall **120** and extend circumferentially about the engagement member **116**. The slots **117**, **118** receive at least one fastener, which may include a bolt **125** and a nut **126**, for removably connecting the clamp members **130**, **140** to the engagement member **116** and the distal end **104** of the strut body **101**. The at least one fastener **125**, **126** also engages the clamp members **130**, **140** to draw the clamp members **130**, **140** together about the compression member **11** of the brake beam assembly **10**, as shown in FIGS. **1** and **2**, to non-rotatably fasten the clamp members **130**, **140** on the compression member **11**.

Each of the first clamp member **130** and the second clamp member **140** includes a respective U-shaped clamping portion **131**, **141** for engaging the compression member of the brake beam assembly, and a respective connection portion **132**, **142** for engaging the engagement member **116** of the strut body **101**. Each connection portion **132**, **142** of the clamp members **130**, **140** includes a respective semi-circular wall **134**, **144**, which defines a respective semi-cylindrical recess **133**, **143** that receives a portion of the engagement member **116** of the strut body **101** when the clamp members **130**, **140** are attached to the strut body **101**.

As shown in FIGS. **4-6**, the opposing ends of the semi-circular walls **134**, **144** of the clamp members **130**, **140** are provided with complementary protrusions **135**, **145** and recesses **136**, **146**, which fit together to provide a mating engagement between the semi-circular walls **134**, **144** of the clamp members **130**, **140**. In particular, a protrusion **135** on one end of the semi-circular wall **134** of the first clamp member **130** fits within a corresponding recess **146** in an opposing end of the semi-circular wall **144** of the second clamp member **140**. Likewise, a protrusion **145** on another end of the semi-circular wall **144** of the second clamp member **140** fits within a corresponding recess **136** in an opposing end of the semi-circular wall **134** of the first clamp member **130**.

The outside surface of each of the semi-circular walls **134**, **144** of the clamp members **130**, **140** includes a respective boss portion **137**, **147** that supports the fastener **125** extending through the clamp members **130**, **140**. Respective holes **138**, **148** are defined in the boss portions **137**, **147** and semi-circular walls **134**, **144** of the clamp members **130**, **140** for receiving the fastener **125** that connects the clamp members **130**, **140** to the engagement member **116** of the strut body **101**.

In particular, to connect the clamp members **130**, **140** to the engagement member **116** of the strut body **101**, the clamp members **130**, **140** are fitted together over the engagement member **116** as discussed above and the fastener **125** is passed through the holes **138**, **148** in the semi-circular walls **134**, **144** of the clamp members **130**, **140** and through the opposing slots **117**, **118** of the hollow cylindrical member of the engagement member **116**. Thus, when the clamp members **130**, **140** are fastened together and to the engagement member **116**, the strut body **101** is able to rotate about the longitudinal axis L with respect to the clamp members **130**, **140**. The amount that the strut body **101** is able to rotate about the longitudinal axis L is dependent upon the circumferential length of the slots **117**, **118** in the cylindrical wall **120** of the engagement member **116**, the ends of which act as stops for relative movement of the engagement member **116** with respect to the fastener **125** and, thus, the clamp members **130**, **140**. According to one embodiment, the slots **117**, **118** are sized such that the strut body **101** is able to rotate approximately 80° about the longitudinal axis L with respect to the clamp members **130**, **140**.

As shown in FIGS. **3-6**, the strut body **101** includes the proximal wall disposed at the proximal end **103** of the strut body **101**, which defines a proximal end surface **121** of the strut body **101**. An opening **119** is defined in the proximal wall. The tension member engager **150** includes an engagement portion **151** that has a channel **152** defined therein, which is configured to receive the tension member of the brake beam assembly. The engagement portion **151** also includes a distal wall **154** that defines a distal surface **155** of the engagement portion **151**. A cylindrical stem **153** extends from the distal wall **154** of the engagement portion **151**. The cylindrical stem **153** of the tension member engager **150** is received in the opening **119** in the proximal wall of the strut body **101**. The cylindrical stem **153** is received within the opening **119** with a loose fit. Accordingly, the strut body **101** is freely rotatable with respect to the tension member engager **150**. During use, the cylindrical stem **153** of the tension member engager **150** is inserted into the opening **119** such that the distal surface **155** of the distal wall **154** of the engagement portion **151** of the tension member engager **150** engages the proximal end surface **121** of the strut body **101**. The tension member engager **150** is held against the strut body **101** by the tension member of the brake beam assembly.

As discussed above, the strut body **101** is connected to the clamp members **130**, **140** and the tension member engager **150** to be rotatable about the longitudinal axis L of the strut body **101** with respect to the clamp members **130**, **140** and the tension member engager **150**. Accordingly, the slot **111** defined in the strut body **101** may be oriented at opposing angles with respect to a horizontal plane extending through the longitudinal axis L of the strut body **101**. In particular, the slot **111** in the strut body **101** may be oriented at opposing angles of 40° with respect to the horizontal plane and the strut body **101** is rotatable for a total angle of at least 80° about the longitudinal axis L of the strut body **101**.

With reference to FIGS. **7-10**, a strut **200**, for use as the strut **20** in the assembly shown in FIGS. **1** and **2**, is shown in accordance with another embodiment. The strut **200** is identical to the strut **100** discussed above with respect to FIGS. **3-6**, but for the engagement between a strut body **201** and a tension member engager **250**. The strut **200** includes the strut body **201** extending along a longitudinal axis L between a proximal end **203** defined by a proximal wall and a distal end **204** defined by a distal wall. The strut body **201** includes the proximal wall disposed at the proximal end **203** of the strut body **201**, which defines a proximal end surface **205** of the strut body **201**. An opening **219** is defined in the proximal wall. The tension member engager **250** includes an engagement portion **251** that has a channel **252** defined therein, which is configured to receive the tension member of the brake beam assembly. The engagement portion **251** also includes a distal wall **254** that defines a distal surface **256** of the engagement portion **251**. A cylindrical stem **253** extends from the distal wall **254** of the engagement portion **251**. The cylindrical stem **253** of the tension member engager **250** is received in the opening **219** in the proximal wall of the strut body **201**. The cylindrical stem **253** is received within the opening **219** with a loose fit. Accordingly, the strut body **201** is rotatable with respect to the tension member engager **250**.

Further, as shown in FIGS. **8-10**, the proximal end surface **205** of the proximal wall of the strut body **201** includes at least one key protrusion **206** extending across the proximal end surface **205** on at least one side of the opening **219**. In particular, the at least one key protrusion **206** includes two key protrusions **206** extending across the proximal end surface **205** on both sides of the opening **219**. The distal surface **256** of the distal wall **254** of the engagement portion **251** of the tension member engager **250** includes at least one key groove **255**. In particular, the at least one key groove **255** includes a plurality of key grooves **255**. The key grooves **255** have a shape complementary to the shape of the key protrusions **206** on the proximal end surface **205** of the strut body **201**. During use, the cylindrical stem **253** of the tension member engager **250** is inserted into the opening **219** such that the distal surface **256** of the distal wall **254** of the engagement portion **251** of the tension member engager **250** engages the proximal end surface **205** of the strut body **201**. The tension member engager **250** is held against the strut body **201** by the tension member of the brake beam assembly. The key protrusions **206** engage the key grooves **255** to prevent rotation of the strut body **201** with respect to the tension member engager **250** when the proximal end surface **205** of the strut body **201** and the distal surface **256** of the engagement portion **251** of the tension member engager **250** are abutting. The key grooves **255** are appropriately angled with respect to the key protrusions **206** so that the strut body **201** is retained in position with the slot aligned in one of the opposing 40° angles. In order to rotate the strut body **201** when the strut **200** is assembled in the brake beam assembly, the strut body **201** is pulled or levered apart from the tension member engager **250** and the strut body **201** can be rotated until the key protrusions **206** re-engage a different set of key grooves **255** at an opposing orientation of the strut body **201**.

With reference to FIGS. **11-13**, a strut **300**, for use as the strut **20** in the assembly shown in FIGS. **1** and **2**, is shown in accordance with another embodiment. The strut **300** is identical to the strut **100** discussed above with respect to FIGS. **3-6**, but for the configuration of the apertures in an engagement member **316**. The strut **300** includes a strut body **301** extending along a longitudinal axis L between a proximal end **303** defined by a proximal wall and a distal end **304** defined by a distal wall. The engagement member **316** is a hollow cylindrical member that includes a cylindrical wall **320** having two pairs of opposing holes **317**, **318** defined therein for receiving the fastener **125**. The clamp members **130**, **140** are secured to the engagement member **316** of the strut body **301** and fastened on the compression member **11** of the brake beam assembly **10** (shown in FIGS. **1** and **2**) by passing the fastener **125** through the clamp members **130**, **140** and through one of the pairs of opposing holes **317**, **318**, which align the strut body **301** at one of the opposing angles with respect to the horizontal plane described above with reference to FIGS. **1** and **2**. In order to change the configuration of the strut body **301**, the fastener **125** is removed from the clamp members **130**, **140** and the engagement member **316**; the strut body **301** and the engagement member **316** are rotated such that a different pair of opposing holes **317**, **318** is aligned with the clamp members **130**, **140**; and the fastener **125** is replaced to secure the clamp members **130**, **140** to the engagement member **316**.

With reference to FIGS. **14-17**, a strut **400**, for use as the strut **20** in the assembly shown in FIGS. **1** and **2**, is shown in accordance with another embodiment. The strut **400** is identical to the strut **100** discussed above with respect to FIGS. **3-6**, but for the configuration of an engagement member **416** and clamp members **430**, **440**. The strut **400** includes a strut body **401** extending along a longitudinal axis L between a proximal end **403** defined by a proximal wall and a distal end **404** defined by a distal wall. The clamp members **430**, **440** each include a respective U-shaped clamping portion **431**, **441** and a respective semi-circular connection portion **432**, **442** that engages the engagement member **416** of the strut body **401**. As shown in FIG. **17**, a semi-circular wall **444** of the connection portion **442** of the second clamp member **440** is inwardly inclined such that a semi-cylindrical recess **443** has a dove-tail shape. It is to be appreciated that, though not shown, the first clamp member **430** has a similar configuration of inwardly inclined semi-circular wall and dove-tail shaped recess as the second clamp member **440**, shown in FIG. **17**. The engagement member **416** of the strut body **401** is a dove-tail shaped member inclined outwardly from the distal end **404** of the strut body **401** to form a mating engagement with the connection portion **432**, **442** of each of the clamp members **430**, **440**. A wall of the engagement member **416** is cut-away at opposing positions of the engagement member **416** to form slots **417** for receiving the fastener **125** for securing the clamp members **430**, **440** to the engagement member **416**. The slots **417** may be provided with a circumferential length to define an 80° arc that allows the strut body **401** to rotate about the longitudinal axis L with respect to the clamp members **430**, **440** between the opposing angles.

With reference to FIGS. **18-21**, a strut **500**, for use as the strut **20** in the assembly shown in FIGS. **1** and **2**, is shown in accordance with another embodiment. The strut **500** includes a strut body **501** extending along a longitudinal axis L between a proximal end **503** and a distal end **504**. The strut body **501** includes an internal wall defining an internal cavity **502** extending longitudinally through the strut body **501** from the proximal end **503** of the strut body **501** to the distal end **504** of the strut body **501**. Two pairs of opposing elongated openings **505** extend through the strut body **501** from the internal wall to an exterior of the strut body **501** to place the internal cavity **502** in communication with the exterior of the strut body **501**. The openings **505** each include an arcuate notch **506** to allow a fastener **125** to extend through the openings **505** for securing a brake lever to the strut **500**. The strut body **501** includes a first stationary portion that is non-rotatably connected to a compression member engager **514**, **520** and a tension member engager **525**. The first stationary portion includes the internal wall defining the internal cavity **502** and at least partially defines the proximal end **503** and the distal end **504** of the strut body **501**.

The strut body **501** also includes a second portion, which includes a strut insert **507** that is slidably and rotatably disposed within the internal cavity **502** of the strut body **501**. The strut insert **507** is a U-shaped member defined by a proximal wall **508** and two upstanding cylindrical sidewalls **509**, **510** that conform to the shape of the internal cavity **502** of the strut body **501**. The sidewalls **509**, **510** are spaced apart to define a separation **513** in the strut insert **507** that is configured to receive and support the brake lever. Openings **511**, **512** are defined in each of the respective sidewalls **509**, **510** near the distal end of the strut insert **507** for receiving the fastener pivotably supporting the brake lever on the strut **500**. The strut insert **507** is rotatably received in the internal cavity **502** with the proximal wall **508** of the strut insert **507** positioned at the proximal end **503** of the strut body **501**. The strut insert **507** is rotated within the internal cavity **502** of the strut body **501** to align the separation **513** with one of the pairs of opposing elongated openings **505** to form a slot for receiving and supporting the brake lever. In particular, the openings **505** in the strut body **501** are positioned to align the brake lever at one of the two opposing 40° angles. The fastener is extended through the other of the pair of openings **505** not defining the slot and the openings **511**, **512** in the strut insert **507**.

As shown in FIGS. **18-21**, the compression member engager of the strut **500** includes a clamp assembly engaging the compression member **11** of the brake beam assembly **10** (shown in FIGS. **1** and **2**). The clamp assembly includes a first U-shaped clamp member **514** fixedly disposed on the distal end **504** of the strut body **501**, which is configured to engage the compression member of the brake beam assembly. A raised protrusion **515** is provided adjacent to the clamp member **514** and includes a hole **516** defined therein for receiving and supporting the fastener **125** extending through the strut body **501**. A recess **517** for receiving a second clamp member **520** of the clamp assembly is also defined in the distal end **504** of the strut body **501** alongside the clamp member **514**.

As shown in FIGS. **19-21**, the second clamp member **520** includes a U-shaped clamping portion **521** configured to engage the compression member of the brake beam assembly. The second clamp member **520** also includes a cylindrical connection portion **522** that engages with the recess **517** in the distal end **504** of the strut body **501**. The cylindrical connection portion **522** also includes a hole **523** defined therein for receiving the fastener **125**. Accordingly, the second clamp member **520** is removably secured to the distal end **504** of the strut body **501** by the fastener **125**, **126**, such that the clamping portion **521** of the second clamp member **520** is aligned with the first clamp member **514** of the clamp assembly and the clamping portion **521** cooperates with the first clamp member **514** to secure the strut **500** to the compression member of the brake beam assembly. The fastener **125**, **126** also non-rotatably fastens the first and second clamp members **514**, **520** on the compression member by drawing them together about the compression member.

Further, as shown in FIGS. **18-21**, the tension member engager **525** of the strut **500** is integrally formed in the proximal end **503** of the strut body **501**. The tension member engager **525** has a channel **526** defined therein configured to receive the tension member of the brake beam assembly.

With reference to FIGS. **22-24**, a brake beam assembly **600** is shown according to another embodiment. The brake beam assembly **600** includes a compression member **601** having a first end **604** and a second end **605**, and a tension member **602** having a first end **606** and a second end **607** and a substantially V-shape defining an apex **603**. As shown, the compression member **601** may be a square L-beam having a vertical leg **601***a* and a horizontal leg **601***b*. The tension member **602** may be a flat member bent at its center to form the apex **603**. The first end **606** and the second end **607** of the tension member **602** are connected to the first end **604** and the second end **605** of the compression member **601**, respectively. A brake head **608** is provided at each end of the brake beam assembly **600**. Each brake head **608** includes a recess in which the respective ends **604**, **605**, **606**, **607** of the compression member **601** and the tension member **602** are at least partially received. In particular, the first and second ends **604**, **605** of the compression member **601** and the first and second ends **606**, **607** of the tension member **602** include holes **610** defined therein which may be aligned when the tension member **602** is assembled onto the horizontal leg **601***b* of the compression member **601** such that the compression member **601** and the tension member **602** may be secured with fasteners **609**. Some or all of the holes **610** may also be aligned with holes extending through the respective brake head **608** such that the fasteners **609** also serve to connect the brake heads **608** to the respective ends **604**, **605**, **606**, **607** of the compression member **601** and the tension member **602**.

As shown in FIGS. **22-24**, a strut **620** extends between the compression member **601** and the apex **603** of the tension member **602**. The strut **620** includes a strut body **621** that has at least one slot defined therein that receives and supports a brake lever **18** (shown in FIGS. **1** and **2**) of a brake actuator assembly, which extends through the strut body **621** non-parallel to the longitudinal axis L of the strut body **621**. At least a portion of the strut body **621** is rotatable about the longitudinal axis L of the strut body **621** with respect to the strut **620** such that the at least one slot may be oriented at opposing angles with respect to a horizontal plane defined by the first end **604** and the second end **605** of the compression member **601** and the apex **603** of the tension member **602**. Accordingly, the brake lever retained within the slot will also be oriented at one of the opposing angles such that the brake lever can be positioned in a right-hand configuration or a left-hand configuration depending upon the need for one configuration or the other as a replacement part. In particular, the rotatable portion of the strut body **621** is rotatable to orient the slot at opposing angles of about 40° with respect to the horizontal plane defined by the ends **604**, **605** of the compression member **601** and the apex **603** of the tension member **602**. Accordingly, the rotatable portion of the strut body **621** is rotatable at least 80° about the longitudinal axis L of the strut body **621** such that the slot can receive the brake lever at one of the two opposing 40° angles with respect to the horizontal plane, as is illustrated in FIGS. **1** and **2** with reference to another embodiment.

With reference to FIGS. **22-29**, the strut **620** includes a strut body **621** extending along a longitudinal axis L between a proximal end **623** and a distal end **624**. The strut **620** also includes a compression member engager **634** connected to the distal end **624** of the strut body **621**, which connects the strut body **621** to the compression member **601**, and a tension member engager **638** connected to the proximal end **623** of the strut body **621**, which engages the tension member **602** at the apex **603**.

The strut body **621** includes an internal wall defining an internal cavity **622** extending longitudinally through the strut body **621** from the proximal end **623** of the strut body **621** to the distal end **624** of the strut body **621**. The proximal end **623** of the strut body **621** is defined by a wall that closes off the internal cavity **622**. The distal end **624** of the strut body **621** is defined by an opening that allows access to the internal cavity **622**. Two pairs of opposing elongated openings **625** extend through the strut body **621** from the internal wall to an exterior of the strut body **621** to place the internal cavity **622** in communication with the exterior of the strut body **621**. The openings **625** each include an arcuate notch **626** to allow a fastener to extend through the openings **625** for securing a brake lever to the strut **620**. The strut body **621** includes a first stationary portion that is non-rotatably connected to the compression member engager **634** and the tension member engager **638**. The first stationary portion includes the internal wall defining the internal cavity **622**, and at least partially defines the proximal end **623** and the distal end **624** of the strut body **621**.

The strut body **621** also includes a second portion, which includes a strut insert **627** that is slidably and rotatably disposed within the internal cavity **622** of the strut body **621**. The strut insert **627** is a U-shaped member defined by a proximal wall **628** and two upstanding cylindrical sidewalls **629**, **630** that conform to the shape of the internal cavity **622** of the strut body **621**. The sidewalls **629**, **630** are spaced apart to define a separation **633** in the strut insert **627** that is configured to receive and support the brake lever. Openings **631**, **632** are defined in each of the respective sidewalls **629**, **630** near the distal end of the strut insert **627** for receiving the fastener pivotably supporting the brake lever on the strut **620**. The strut insert **627** is rotatably received in the internal cavity **622** with the proximal wall **628** of the strut insert **627** positioned at the proximal end **623** of the strut body **621**. The strut insert **627** is rotated about the longitudinal axis L within the internal cavity **622** of the strut body **621** with respect to the stationary portion of the strut body **621**, the compression member engager **634**, and the tension member engager **638** to align the separation **633** with one of the pairs of opposing elongated openings **625** to form a slot for receiving and supporting the brake lever. In particular, the openings **625** in the strut body **621** are positioned to align the brake lever at one of the two opposing 40° angles. The fastener is extended through the other of the pair of openings **625** not defining the slot and the openings **631**, **632** in the strut insert **627**. The distal end **624** of the strut body **621** is defined by the opening, which provides access to the internal cavity **622** for placement of the strut insert **627** in the internal cavity **622**.

As shown in FIGS. **22-29**, the compression member engager **634** of the strut **620** includes an extension of the strut body **621** on an upper side of the strut body **621** extending past the distal end **624** of the strut body **621** to engage the compression member **601** of the brake beam assembly **600**. The compression member engager **634** also includes at least one tab **635** extending from a side of the extension. In particular, two tabs **635** extend from the lateral sides of the extension. The tabs **635** each include an opening **636** that receives a fastener **637**, which non-rotatably fastens the compression member engager **634** on the compression member **601** to connect the strut body **621** to the compression member **601**. As shown in FIGS. **22-24**, when fastened, the compression member **601** overlaps with the opening in the distal end **624** of the strut body **621**.

Further, as shown in FIGS. **22-29**, the tension member engager **638** of the strut **620** is integrally formed in the proximal end **623** of the strut body **621**. The tension member engager **638** has a channel **639** defined therein configured to receive the tension member of the brake beam assembly.

It is to be appreciated that the components of the strut **20**, **100**, **200**, **300**, **400**, **500**, **620** according to any one of the above-discussed embodiments may be formed from any material or materials known to be suitable to those having ordinary skill in the art. According to a particular embodiment, the strut **20**, **100**, **200**, **300**, **400**, **500**, **620** is formed entirely or partially from cast iron materials.

With reference to the above-detailed embodiments, a method of changing an orientation of a strut of a brake beam assembly, according to one embodiment, includes the steps of providing a strut **20**, **100**, **200**, **300**, **400**, **500**, **620** according to any one of the above-detailed embodiments and rotating at least a portion of the strut body **21**, **101**, **201**, **301**, **401**, **501**, **621** in a direction about the longitudinal axis L of the strut body **21**, **101**, **201**, **301**, **401**, **501**, **621** with respect to the compression member engager and the tension member engager to orient the slot at an angle with respect to the horizontal plane extending through the longitudinal axis L of the strut body **21**, **101**, **201**, **301**, **401**, **501**, **621**. The method may further include the step of rotating the at least a portion of the strut body **21**, **101**, **201**, **301**, **401**, **501**, **621** in an opposing direction about the longitudinal axis L of the strut body **21**, **101**, **201**, **301**, **401**, **501**, **621** with respect to the compression member engager and the tension member engager to orient the slot at a reverse angle with respect to the horizontal plane. The angle may be about 40° in the direction about the longitudinal axis L and the reverse angle may be about 40° in the opposing direction about the longitudinal axis L.

While embodiments of a universal brake beam strut were provided in the foregoing description, those skilled in the art may make modifications and alterations to these embodiments without departing from the scope and spirit of the invention. Accordingly, the foregoing description is intended to be illustrative rather than restrictive. The invention described hereinabove is defined by the appended claims and all changes to the invention that fall within the meaning and the range of equivalency of the claims are to be embraced within their scope.

The invention claimed is:

1. A strut for a brake beam assembly, the strut comprising:

a strut body extending along a longitudinal axis between a proximal end and a distal end, the strut body including at least one slot defined in the strut body configured to receive and support a brake lever;

a compression member engager configured to connect the strut body to a compression member of the brake beam assembly, the compression member engager being connected to the distal end of the strut body; and

a tension member engager configured to engage a tension member of the brake beam assembly, the tension member engager being connected to the proximal end of the strut body,

wherein the strut body comprises a stationary portion defining the proximal end of the strut body and the distal end of the strut body, wherein the stationary portion of the strut body is non-rotatably connected to the compression member engager and the tension member engager, and wherein the stationary portion of the strut body includes an internal wall defining an internal cavity of the strut body extending longitudinally through the strut body from the proximal end of the strut body to the distal end of the strut body and two pairs of opposing elongated openings extending through the strut body from the internal wall to an exterior of the strut body,

wherein the strut body also comprises a strut insert slidably and rotatably disposed within the internal cavity of the strut body, wherein the strut insert at least partially defines the at least one slot and is rotatable within the internal cavity of the strut body about the longitudinal axis of the strut body with respect to the stationary portion of the strut body, the compression member engager, and the tension member engager such that the at least one slot may be oriented at opposing angles with respect to a horizontal plane extending through the longitudinal axis of the strut body, and

wherein the at least one slot of the strut body is defined by the strut insert and at least one pair of the two pairs of opposing elongated openings.

2. The strut for a brake beam assembly according to claim **1**, wherein the opposing angles are about 40° with respect to the horizontal plane and the strut insert is rotatable at least 80° about the longitudinal axis of the strut body.

3. The strut for a brake beam assembly according to claim **1**, wherein the strut insert comprises a U-shaped member defined by a proximal wall and two spaced-apart sidewalls that define a separation extending along the longitudinal axis of the strut body, and

wherein the separation of the strut insert is aligned with one pair of the two pairs of opposing elongated openings to form the at least one slot of the strut body.

4. The strut for a brake beam assembly according to claim **3**, wherein each of the two spaced-apart sidewalls of the strut insert includes an opening configured to receive a fastener for connecting the brake lever to the strut body.

5. The strut for a brake beam assembly according to claim **1**, wherein the distal end of the strut body is defined by an opening providing access to the internal cavity for placement of the strut insert in the internal cavity.

6. The strut for a brake beam assembly according to claim **1**, wherein each of the elongated openings includes an arcuate portion configured to accommodate a fastener for connecting the brake lever to the strut body.

7. The strut for a brake beam assembly according to claim **1**, wherein the compression member engager comprises an extension on an upper side of the strut body extending past the distal end of the strut body and at least one tab extending from a side of the extension, the at least one tab including an opening configured to receive a fastener for fastening the compression member engager on the compression member of the brake beam assembly.

8. The strut for a brake beam assembly according to claim **1**, wherein the compression member engager comprises a clamp assembly configured to engage the compression member of the brake beam assembly, and

wherein the clamp assembly includes a first clamp member disposed on the distal end of the strut body, a second clamp member removably secured to the distal end of the strut body to be aligned with the first clamp member, and at least one fastener configured to connect the second clamp member to the strut body and to fasten the clamp assembly on the compression member.

9. The strut for a brake beam assembly according to claim **1**, wherein the tension member engager is integrally formed in the proximal end of the strut body and has a channel defined therein configured to receive the tension member.

10. A brake beam assembly, comprising:

a compression member having a first end and a second end;

a tension member having a first end and a second end and defining a substantially V-shape with an apex, the first and second ends of the tension member being connected to the first and second ends of the compression member, respectively; and

a strut extending between the compression member and the apex of the tension member, the strut comprising:

a strut body extending along a longitudinal axis between a proximal end and a distal end, the strut body including at least one slot defined in the strut body configured to receive and support a brake lever;

a compression member engager connecting the strut body to the compression member, the compression member engager being connected to the distal end of the strut body; and

a tension member engager engaging the tension member at the apex, the tension member engager being connected to the proximal end of the strut body,

wherein the strut body comprises a stationary portion defining the proximal end of the strut body and the distal end of the strut body, wherein the stationary portion of the strut body is non-rotatably connected to the compression member engager and the tension member engager, and wherein the stationary portion of the strut body includes an internal wall defining an internal cavity of the strut body extending longitudinally through the strut body from the proximal end of the strut body to the distal end of the strut body and two pairs of opposing elongated openings extending through the strut body from the internal wall to an exterior of the strut body,

wherein the strut body also comprises a strut insert slidably and rotatably disposed within the internal cavity of the strut body, wherein the strut insert at least partially defines the at least one slot and is rotatable within the internal cavity of the strut body about the longitudinal axis of the strut body with respect to the stationary portion of the strut body, the compression member engager, and the tension member engager such that the at least one slot may be oriented at opposing angles with respect to a horizontal plane extending through the longitudinal axis of the strut body, and

wherein the at least one slot of the strut body is defined by the strut insert and at least one pair of the two pairs of opposing elongated openings.

11. The brake beam assembly according to claim **10**, wherein the opposing angles are about 40° with respect to the horizontal plane and the strut insert is rotatable at least 80° about the longitudinal axis of the strut body.

12. The brake beam assembly according to claim **10**, wherein the strut insert comprises a U-shaped member defined by a proximal wall and two spaced-apart sidewalls that define a separation extending along the longitudinal axis of the strut body, and

wherein the separation of the strut insert is aligned with one pair of the two pairs of opposing elongated openings to form the at least one slot of the strut body.

13. The brake beam assembly according to claim **10**, wherein the distal end of the strut body is defined by an opening providing access to the internal cavity for placement of the strut insert in the internal cavity.

14. The brake beam assembly according to claim **10**, wherein the compression member engager comprises an extension on an upper side of the strut body extending past the distal end of the strut body and at least one tab extending from a side of the extension, the at least one tab including an opening configured to receive a fastener for fastening the compression member engager on the compression member of the brake beam assembly.

15. The brake beam assembly according to claim **10**, wherein the compression member engager comprises a clamp assembly configured to engage the compression member of the brake beam assembly, and

wherein the clamp assembly includes a first clamp member disposed on the distal end of the strut body, a second clamp member removably secured to the distal end of the strut body to be aligned with the first clamp member, and at least one fastener configured to connect the second clamp member to the strut body and to fasten the clamp assembly on the compression member.

16. The brake beam assembly according to claim **10**, wherein the tension member engager is integrally formed in the proximal end of the strut body and has a channel defined therein configured to receive the tension member.

17. A strut for a brake beam assembly, the strut comprising:

a strut body extending along a longitudinal axis between a proximal end and a distal end, the strut body including at least one slot defined in the strut body configured to receive and support a brake lever extending through the strut body non-parallel to the longitudinal axis of the strut body;

a compression member engager configured to connect the strut body to a compression member of the brake beam assembly, the compression member engager being connected to the distal end of the strut body;

at least one fastener configured to engage the compression member engager to fasten the compression member engager on the compression member; and

a tension member engager configured to engage a tension member of the brake beam assembly, the tension member engager being connected to the proximal end of the strut body,

wherein at least a portion of the strut body is rotatable about the longitudinal axis of the strut body with respect to the compression member engager and the tension member engager such that the at least one slot may be oriented at opposing angles with respect to a horizontal plane extending through the longitudinal axis of the strut body,

wherein the compression member engager comprises at least two clamp members removably connected to the strut body by the at least one fastener, and

wherein the at least one fastener is configured to connect the strut body to the at least two clamp bodies such that the strut body is fixed in a position oriented at one of the opposing angles, and wherein the at least one fastener is configured to cause the at least two clamp bodies to non-rotatably engage the compression member.

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